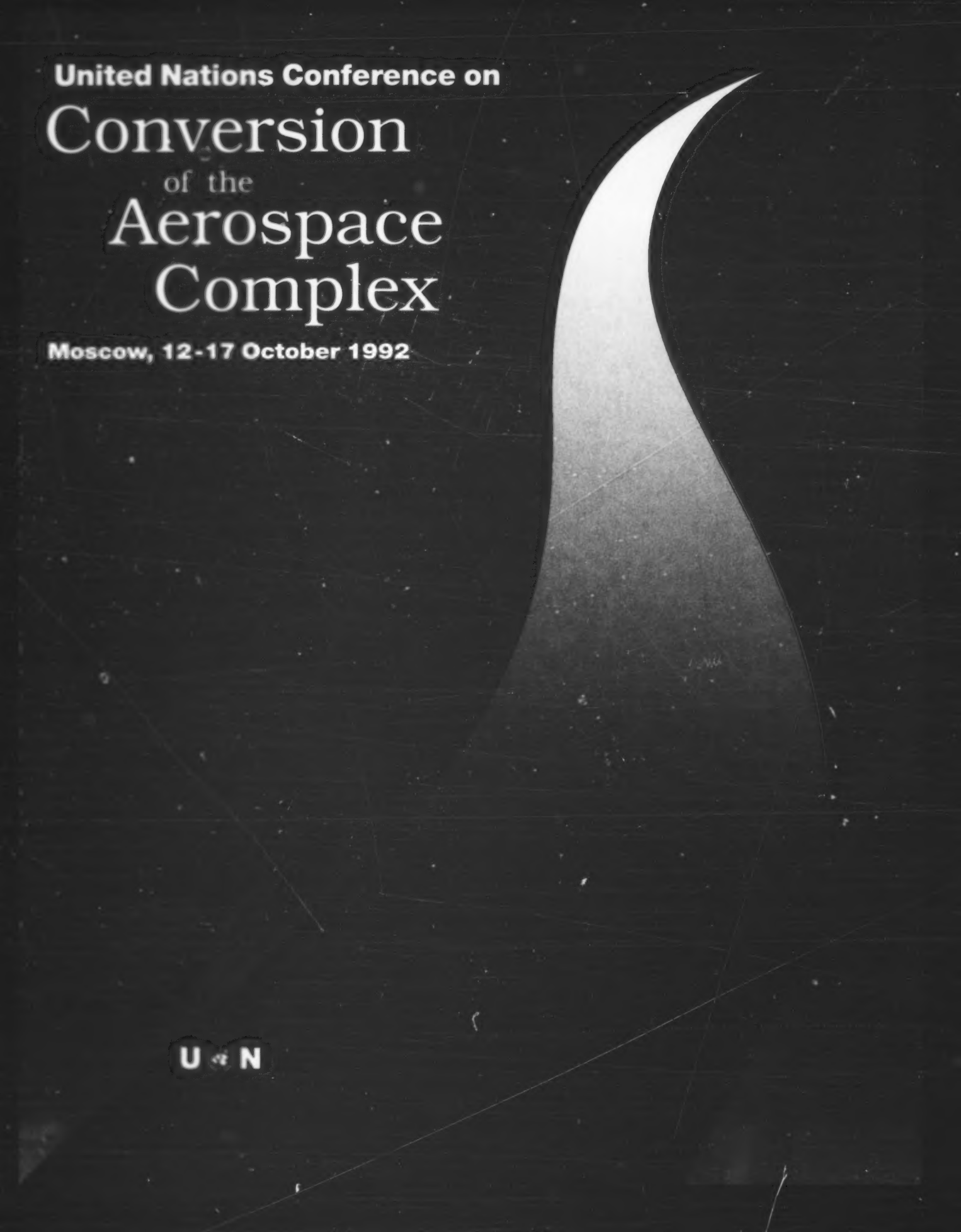
United Nations Conference on

Conversion of the Aerospace Complex

Moscow, 12-17 October 1992



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Department of Economic and Social Development

Report of the United Nations Conference on

Conversion of the Aerospace Complex

Technology Assessment for Development

Organized in cooperation with the
Government of the Russian Federation
Moscow, 12-17 October 1992

United Nations
New York, 1993

This Conference report is a supplement to the Advanced Technology Assessment System (ATAS) *Bulletin*. The ATAS *Bulletin* is a recurrent publication of the former Centre for Science and Technology for Development, United Nations Secretariat, New York. The functions previously carried out by the Centre have now been assumed by the Science, Technology, Energy, Environment and Natural Resources Division within the Department of Economic and Social Development, established in February 1992.

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Foreword

Détente and the radical change in the global political climate have created a novel situation in which conversion from a military to a civilian economy has for the first time become a feasible, though very difficult, task.

In recognition of the role of conversion in the contemporary world, the United Nations initiated and organized broad international discussions on the implications of conversion, and on ways to soften the economic and social repercussions of reduced military expenditures experienced during the first phase of the conversion process.

Policy makers and planners, academic experts, high-level executives from military industry, and representatives of many international organizations met in Moscow (August 1990), Beijing (October 1991) and Dortmund (February 1992) to analyse various options and specific approaches to conversion strategy in relation to socio-economic progress, environmental protection and sustainable development. The participants stated that conversion should be considered as an integral part of the disarmament process and they developed a number of recommendations and actions to be taken at international and national levels.

The present report is being published as a supplement to the Advanced Technology Assessment System (ATAS) *Bulletin*. It describes the most recent activities of the United Nations in the area of military conversion. The Conference, held in Moscow from 12-17 October 1992, was organized by the Department of Economic and Social Development and the Government of the Russian Federation, in close cooperation with the United Nations Development Programme and in collaboration with the United Nations Educational, Scientific and Cultural Organization, and the United Nations Industrial Development Organization. In recognizing the interdisciplinary nature of conversion, the Department, as an organizer of the meeting and the focal point for technology assessment within the United Nations system, has focused primarily on technology assessment issues in this report.

The Conference identified and assessed those aerospace technologies that are suitable for dual use and conversion, and that have the potential for secondary applications and spin-offs in development-related applications. It examined those areas of international cooperation that are most likely to ensure access to such technologies by interested developing countries and countries in transition. The Conference also focused on science and technology policy options and on commercialization and legal issues, in order to facilitate technological change in the context of development objectives and strategies, to help identify the main barriers and possible bottlenecks of this process, and to understand the nature of such barriers and propose a portfolio of options.

The proposed follow-up activities and specific suggestions for action emanating from the Conference are to be presented to policy makers, the international community, researchers and commercial enterprises through the present report and through the *Moscow Declaration, 1992*—the final document of the Conference.

Conference highlights

This was the first United Nations conference to discuss conversion in relation to a specific industry. The technology assessment approach and methodology developed for the project could be applied to dual-use technologies in other areas (the nuclear and biotechnology industries and informatics, for example).

The Conference worked out a number of specific action-oriented recommendations addressed to policy makers, the international community and the private sector. Future workshops will develop specific plans of action for implementation of a number of the recommendations.

It was a novel but successful example of a project in which the Department closely cooperated with both the political sector of the United Nations and the United Nations Development Programme.

Initial responses to the Conference

The University of Texas proposed that a follow-up meeting be held in Texas in the spring of 1994 that would focus on global environmental and developmental problems in the context of technology assessment and the conversion of the aerospace complex. The meeting would concentrate on the concept of a global network for environmental monitoring and elaborate a plan of international cooperation for the network's practical realization that reflects the spirit of *Agenda 21* of the United Nations Conference on Environment and Development;

The authorities of the Russian Federation took the decision to set up a National Centre for Conversion of the Aerospace Complex. The Centre, organized by a special Decree of President Boris Yeltsin, will play an important role in harmonization of the activities and international cooperation in this area;

It was recommended that a programme in management training to support the restructuring of the military-industrial complex of the Russian Federation be established. The authors of this project—developed by the University of Dortmund, Germany, and proposed for incorporation within the European Community programme of technical aid for Russia—would draw on the recommendations of the *Moscow Declaration, 1992* in promoting this activity.

In this era of global concern for the environment, the persistent economic gap between the industrialized and developing countries, and the process of détente and disarmament in the post-cold-war climate, conversion of military technology for civilian use and sustainable development could generate a new substantive theme of high importance for economic, social and political development within the United Nations. The economic, social and cumulative effects of conversion could play a prominent role in the global use of peace dividends for sustainable development.

In connection with the funding of the Conference, the United Nations would like to express its appreciation to a member of the Rockefeller family for a generous contribution.

It is hoped that this report will make an essential contribution to United Nations efforts to promote the conversion process in different sectors of military industry, and provide Member States with political, technical and economic advice on military conversion.

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I. Conference objectives and concept highlights

Conference objectives

1. To identify and assess military aerospace technologies suitable for dual use and conversion, and which have the potential for secondary applications and spin-offs in development-related applications.

2. To look for ways and means of international cooperation to ensure access of interested developing countries and countries in transition to such technologies.

3. To focus on science and technology policy options, commercialization and legal issues in order to facilitate technological change in the context of development objectives and strategies.

4. To identify the main barriers and possible bottlenecks of the conversion process, understand the nature of such barriers, and propose a portfolio of options.

Concept highlights

1. ***Technology assessment:*** Which military aerospace technologies could be converted for civilian use? Several technologies are discussed in terms of their effects on the economy, the environment and society.

2. ***Case-study approach:*** Participants from both developing and developed countries present their experiences in assessing, developing and commercializing converted military aerospace technologies.

3. ***Policy orientation:*** Verification of short-, medium- and long-term conversion planning including financing, cooperation, marketing and employment. The future defence potential and the dependency of assistance is examined.

4. ***Environment:*** Remote sensing and environmental monitoring of pollution, forests, agriculture, fisheries, ocean research and ozone contamination.

5. ***Technology options:*** Identification of dual-use aerospace technologies in such areas as communications, education, forecasting, planning and environmental measurements.

6. ***Organizational issues:*** The infrastructure required to mobilize and commercialize converted technologies as well as the institutional support needed for successful research and development.

7. ***Legal issues:*** Administrative and legal frameworks are addressed in order to consider restrictions on traditional secrecy and on international trade.

II. Background

The radical political changes that have recently occurred worldwide, and their implications *vis-à-vis* international security, emphasize the urgent need for countries to undertake transition and adjustment initiatives for converting military industries to civilian use. This is increasingly accepted as a necessary condition of the disarmament process and of sustainable development.

The reallocation of resources–labour, technology, capital, natural resources, services–from military to civilian use is a welcome development. However, the task of actually translating successful disarmament into a peace dividend is proving much more arduous than expected. While the release of resources from the military complex would improve the welfare of developing countries, there are doubts as to whether the international community is adequately prepared to cope with some of the harmful effects of dual-use technology proliferation.

Failure to handle conversion properly can jeopardize not only a country's socio-economic development but also its environment. Conversion presents an especially challenging task for countries in transition. Faced with the pressure of budget cuts and overall economic and political crises, their military industries have been experiencing serious difficulties in adjusting to the needs of the civilian market. All this has made conversion a subject of controversy and the process faces powerful opposition from the military-industrial complex. A similar situation is happening or may happen in many other countries. Conversion is a long and painful process but it is an essential aspect of development, particularly in countries where military industries have traditionally dominated the economy. To maximize a society's rate of return from disarmament requires that the costs of adjustments be minimized and the benefits maximized.

This realization has motivated the United Nations to undertake broad international discussions on the implications of conversion and on ways to soften the economic and social pressures resulting from reduced military expenditures. An initial attempt in this direction is to apply technology assessment to different tangible and intangible technologies within the military complex. Technology assessment, monitoring and forecasting are three main concepts which represent the capacity to develop the information that is essential for policy-making in the development process. These concepts represent important management tools for national Governments and for bilateral and multilateral aid agencies. They are used to assess the social, economic, organizational, institutional and environmental effects of new technologies in developing countries. In addition, the assessment identifies risks to sustainable development that may be associated with given technological processes.

In his review of the implementation of the recommendations and decisions adopted by the United Nations General Assembly in 1978 at its tenth special session devoted to disarmament, the Secretary-General drew attention to new challenges facing the international community, particularly to post-disarmament issues. A far-reaching challenge in this regard is to convert military manufacturing and research and development capacities as well as soldiers and technical personnel to civilian uses. As the Secretary-General pointed out, "This emerging issue highlights the immediate need for post-disarmament efforts as economies and Governments try to transform the military-oriented industrial complex into enterprises serving social, humanitarian and development needs". Consequently, the Secretary-General urged all States to consider methods to alleviate the problems of making the transition to a post-disarmament world. He reiterated that the United Nations stood ready to assist in exploring different aspects of conversion concepts and was therefore establishing an interdepartmental task force at the United Nations to provide Member States with

political, technical and economic advice on the various aspects of such a transition. The United Nations would serve as the appropriate forum for fostering dialogue among all nations so that expertise from developed economies would be shared and that effective, non-discriminatory methods be found for such transition.

It is in this spirit that the United Nations Conference on Conversion of the Aerospace Complex was organized in cooperation with the Government of the Russian Federation, and with generous support from the Department of Economic and Social Development of the United Nations Secretariat, the United Nations Development Programme, the Rockefeller Foundation and the Bainbridge Technology Group. The Conference represents the fourth international dialogue among interested Member States initiated under the aegis of the United Nations to examine the social, political and macroeconomic aspects of conversion. The Conference considered both the narrow and broader interpretations of the conversion process, that is, of converting aerospace production plants for the manufacture of consumer goods, and the process of reallocating resources released from the armed forces and from declining defence industries to the expanding sectors and regions of the economy.

In addition to aerospace technologies, there are other advanced dual-use technologies that are crucial to the defence industry, including informatics, advanced materials, nuclear technology and biotechnology. Nevertheless, aerospace technology is considered the driving force in the process of conversion for sustainable development. On the cost side, the aerospace industry is pivotal to the growth of the defence industry as a whole. On the technological side, this industry has attracted the most advanced technical and human resources and has been the major contractor of defence-related research and development. Furthermore, many aerospace technologies are already in use in civilian applications.

There are convincing arguments for choosing the aerospace sector for conversion: (*a*) the level of technological development of a number of countries active in this sector is roughly equal; and (*b*) the technological state of the art of this sector allows for easier information diffusion and transmission, and for cross-fertilization of experiences. Such factors tend to enhance East-West confidence and the possibilities for cooperative ventures in this area, and include the experience gained from collaboration in the exploration of space—the Apollo-Soyuz programme and other mutual space missions. Moreover, such joint activities might help to expand trust between the participating partners, thus further strengthening international security.

The conversion of aerospace technology to civilian use could be particularly instrumental in the socio-economic and cultural development of the international community as a whole. The creation of a world-wide space system for monitoring the Earth's surface in respect of crops, forests and oil and gas exploration, together with research on the exploitation of the oceans' rich natural resources, could be extremely profitable for all nations, including the least developed countries. Progress in remote sensing could also be used effectively for detailed monitoring of environmental change, including ozone depletion, greenhouse gas formation, deforestation and pollution of forests and waters. Additionally, the importance of global information networks and satellite-based systems for communication and long-term forecasting cannot be overemphasized.

III. Opening statements and greetings

Boris Yeltsin

President of the Russian Federation*

I cordially welcome participants and guests to the United Nations Conference on Conversion of the Aerospace Complex–a Conference that will make it possible to establish closer contacts in a field that has, to a considerable extent, shaped the twentieth century. The participation in the Conference of statesmen from many countries and noted scientists and specialists in diverse fields is a token of the vital importance of the problems that you will be discussing.

In recent decades, the fate of mankind has, in many respects, been reflected in the field of space activities. The division into opposed camps striving for superiority resulted in the use of that branch of science for primarily military purposes. For a long time, outstanding discoveries could not serve the interests of mankind. Today we are on the threshold of a global change.

Outer space must finally acquire its natural significance for mankind, and its inexhaustible potential must be properly used for the progress of civilization and culture. It is within our power to make this change, and the sooner we do it, the more stable will be peace on Earth and the safer will our planet be for its inhabitants.

The aerospace and aircraft industries have always been noted for the most up-to-date technologies, which are inextricably linked with the latest scientific achievements. The use of outer space for civilian purposes will stimulate the progressive development of the entire world economy. This is particularly important for Russian industry, which for many years turned its back on human concerns.

We have been preparing for the next war for such a long time that we are simply yearning for peaceful production.

The conversion of the space industry provides new opportunities for international cooperation. Unfortunately, quite a few barriers still remain in this area, and one of our main tasks is the speedy removal of those barriers. Unity through outer space, which has always attracted and excited the mind and soul of man–this is one of the tasks facing the community of mankind.

May your Conference be one more step towards the solution of that task. I wish you success and new creative achievements!

*Presented by Georgy S. Chyzha, Deputy Prime Minister of the Russian Federation, on behalf of President Yeltsin.

Oleg Lobov

Chairman of the Expert Council to the President of the Russian Federation, Chairman of the Organizing Committee

Ladies and Gentlemen, I have the honour to open this United Nations Conference on Conversion of the Aerospace Complex, which is being held under the auspices of the United Nations and international organizations concerned with science, technology, space and aviation.

In view of the decision taken last night, allow me to give the floor at once, without any introduction, to someone whose connection with conversion is more than casual. He is the government official responsible for it and was himself recently the head of an important defence enterprise in St. Petersburg. The Deputy Prime Minister, Mr. Georgy S. Chyzha, who will give a welcoming address.

Georgy S. Chyzha

Deputy Prime Minister of the Russian Federation

We are in fact now working energetically on practical conversion in every area of military technology. The rate of conversion this year has reached completely unprecedented levels: we have reduced purchases of weapons and military technology and the corresponding production by about 67 per cent.

Personally, I do not consider this very rational. The rate of conversion should ensure not only the elimination of military production but the utilization of all the enormous advances in this field and all the resources expended on the creation of these industries for peaceful purposes, for the change-over to civilian production. But for this, greater resources are undoubtedly needed and, of course, time.

For that reason, our defence industry is now experiencing significant difficulties. Every rouble less spent on the purchase of weapons and military technology requires the expenditure of about 1.3 roubles on all the measures relating to the support and conversion of the enterprises. Accordingly, this is an economic problem which should be resolved over a period of time and programmes are now being developed, worked out, and refined. I think that this will lead to a more civilized and rational rate of conversion, rather than the precipitous rate of conversion we have today.

The aerospace industry should, of course, be given a special place in conversion. In view of its special importance, I consider that a review of the national and industrial policies defining the role of Russian industry in world cooperation and its future role should be completed in the very near future. We should assess our achievements in the various fields of science and technology and establish our future national policy, which should bring us into the world market and provide us with the possibility of developing all our high-technology productive capacities, thus contributing to the development of Russian industry.

For this reason, we naturally assign, and should assign, a special place to the aerospace industry, which has always enjoyed the attention of both the Government and the people. Because the intellectual resources, the capacities of the whole nation were invested in this industry, it is our duty now to make use of these achievements, of everything that was invested in that industry, to employ it for peaceful purposes, to use it not only domestically but in the interests of all humanity.

I think that in the future we will devote state resources to the development of the space industry and use the achievements of that technology to resolve problems connected with the further development of the system of satellite communications, navigation, cartography, ecology and geological research and all those areas in which space technology has applications today.

I think that this vast programme should, of course, be carried out on the basis of close international cooperation. As you know, we are already negotiating with various countries, including the United States, on the establishment of a joint space programme and the use of our rockets for international launches. I consider that these matters will provide the basis for normal conversion and normal international cooperation in this area.

Our partners, it seems to me, should understand that future attempts to limit the penetration of our technology on the international market will not bring prosperity for them and will hinder conversion in Russia. For that reason, the idea of creating special international committees and centres to deal more intensively with questions of international cooperation in the field of space, and the investment of resources from various sources for the development of space programmes, should be welcomed.

The holding of this Conference in Moscow therefore seems to me not only a tribute to our country's services and achievements in space, not only a tribute to the homeland of the cosmonauts but the beginning of a new era, the beginning of a new attitude towards the development of space and, in particular, the development of space technology. Allow me therefore, on behalf of the leadership of this country and its Government, to welcome once again all the participants in this Conference, and to wish you success.

Herbert Levin

Special Adviser to the Under-Secretary-General, Department of Economic and Social Development, United Nations

On behalf of Under-Secretary-General Ji Chaozhu of the United Nations Department of Economic and Social Development, I bring you best wishes for the success of this Conference. He [Mr. Ji] is unable to be here due to his responsibility for certain items on the United Nations General Assembly agenda this week in New York.

Disarmament and arms control has always been a most important issue for the United Nations. Throughout its almost 50-year history, the United Nations paid

special attention to it. However, despite persistent efforts by the international community, heretofore only limited success was achieved with the notable exception of the Nuclear Non-Proliferation Treaty. Today, the improvement of the political climate in the world has made conversion a necessary condition of the disarmament process and of achieving sustainable international development. From a cherished hope, conversion has become a practical issue for developed and developing countries, large and small.

In August 1990, an international conference on "Conversion: Economic Adjustments in the Era of Arms Reduction" took place here in Moscow. About 200 experts from 40 countries discussed conversion policies in countries with market and centrally planned economies. This meeting initiated a process of open exchange of views regarding the key ingredients of conversion concepts. This dialogue continued at a conference held in Beijing in October 1991. At that time, the participants concluded that an approach to conversion strategy should take into consideration the major features of the political and economic systems of countries concerned.

Among these are some which are crucial to defence industries and military forces but which also have applications in the commercial sector and are of broad use to society. The most important dual-use technologies are to be found in the aerospace, informatics, advanced materials, nuclear technology and biotechnology sectors. Aerospace technology should play a paramount role in overall conversion efforts. In economic terms, the aerospace industry is the major sector of the global defence industry. In technological terms, it is the most advanced, as well as being the major purchaser of defence-related research and development. Aerospace technology is particularly suited to the process of conversion for the following reasons:

First, the level of technological development by the major innovators is roughly equal, which tends to enhance mutual confidence and encourage readiness for cooperative ventures.

Secondly, the conversion of aerospace technology to civilian use should be transparent and bring about specific results. The creation of a world-wide space system for the monitoring of the earth's surface in respect of crops and forests, oil and gas exploration, together with research on the exploitation of the oceans' rich natural resources, could be extremely helpful to all nations, including the least developed countries. Progress in remote sensing can also be used for detailed monitoring of environmental change, including ozone depletion, greenhouse gas formation, deforestation and pollution of forests and waters. Additionally, the possible formation of a global information exchange and a satellite-based system for communication and long-term forecasting is of great interest.

Thirdly, the technologies of the aerospace sector are for the most part under government control, which renders them less vulnerable to unauthorized use.

The major objective of this Conference is to identify and assess those aerospace technologies that are suitable for dual use and conversion, and that have the potential for secondary applications and spin-offs in development-related applications. We will examine those areas of international cooperation that are most likely to ensure access to such technologies by interested developing countries and countries in transition.

In this context, progress in the conversion of the "military monster" of aerospace technology to civilian use could enhance the economic and social development of all countries. The conversion of the military aerospace sector could be a realization and embodiment of the biblical dream of hammering swords into ploughshares—the motto of our Conference. We have a chance over the next few days to take a modest step towards a programme of activity in this area that will contribute to global security and sustainable development.

Vladimir Petrovsky

Under-Secretary-General for Political Affairs, United Nations*

I am very pleased to address this United Nations Conference on Conversion of the Aerospace Complex. I extend to you on behalf of the United Nations best wishes for a successful and productive Conference. This Conference takes place in a new and still rapidly changing international situation. This new situation offers new opportunities for peace, cooperation and development, but also poses major new challenges and new risks of economic, social and political instability. The efforts to build a new, stable, democratic world system based on the United Nations Charter must not only promote conflict resolution and disarmament, but must also go to the roots of peace-building through efforts to improve living conditions, broaden access to education and health care, provide communication and transportation services, protect the environment, ensure productive employment, and generally promote economic and social development.

The transition from the era of the cold war to the new era demands creative new responses by all Govern-

*Videotape presentation.

ments and international organizations, not least the United Nations. Already the United Nations has been faced with vast new demands for preventive diplomacy, peace-keeping, peacemaking and peace-building, demands that overstress the existing capacity of our Organization. If the United Nations is to respond effectively to these demands, it must improve and expand its capabilities. There is an urgent need for imaginative new ideas and creative thinking to deal with the new global political and economic problems.

There have been major achievements in the past few years towards a new era of peace and cooperation, notably the Strategic Arms Reduction Treaty, a draft convention banning chemical weapons that will shortly go before the General Assembly, agreements on confidence-building measures, broadening of the Nuclear Non-Proliferation Treaty, and monitoring of international arms sales. Some of these developments, such as the "open-skies" confidence-building measures, provide a direct means of converting military aerospace systems to new uses that increase international security.

However, other disarmament measures, such as the destruction of weapons, the reduction in military budgets and the elimination of military facilities, while essential to improving international security, can also involve substantial economic costs for dismantling processes, for assisting displaced workers, and in lost investments in equipment and facilities. Efforts to cut back on military programmes in a number of countries have already run into resistance on the basis of the economic disruption and hardship they will cause. If the savings that can be realized from disarmament are to be available for real social and economic development, where they are urgently needed, the costs of the transition must be reduced as far as possible.

The conversion of military facilities to civilian uses is therefore a central issue in United Nations efforts towards a new era of global peace, security and development. If the economic problems of conversion can be successfully met, and if it can be clearly demonstrated that disarmament can promote economic and social development, further reduction and elimination of armaments will be greatly encouraged. If, as has been suggested, the military competition of the cold war era is being replaced by economic competition in the new era, we might even see a disarmament race as part of global efforts for development.

It seems clear, however, that conversion will be a difficult process, a process in which there is little experience in any country. Particularly in areas of high technology such as aerospace, much of the equipment and skills is highly specialized and not readily transferable to expanding areas of civilian production. A great deal of careful study and imaginative thinking will be required to identify practical approaches to conversion that adapt equipment and facilities and make use of human skills for more productive purposes.

This Conference focuses on the problem of conversion in the aerospace sector, a high-technology sector that has seen intensive military development over the past half century. Many of the technologies that have been developed for military use and kept secret are well beyond corresponding technologies internationally available for civilian use. These complex and expensive technologies pose particular problems for conversion, particularly for applications that can be of benefit to all countries, including developing countries.

It should be noted that while some applications of aerospace technologies are being made obsolete or redundant by the end of the cold war, new applications of the same or similar technologies are being created. For example, the new and expanded responsibilities being taken on by the United Nations in the areas of preventive diplomacy, peace-keeping and peacemaking include such functions as crisis monitoring, refugee resettlement, cease-fire monitoring, election supervision and redevelopment programmes in areas damaged by conflict. The use of military space technologies such as mobile satellite communications, precision navigation and high-resolution repetitive surveillance for these purposes can improve the capability of the United Nations and other international, regional and national organizations to effectively promote peace, security and development within the limited resources available for these purposes.

The increasing scope of arms control and disarmament agreements and the growing number of countries involved have also created a need for international monitoring and verification, as well as for other confidence-building measures. Military space technologies offer a variety of techniques for monitoring and promoting compliance with arms limitation agreements. Consideration needs to be given to ensuring that all countries benefit from the use of these technologies for such important peaceful purposes.

Another example of aerospace conversion is the use of obsolete ballistic missiles for launching civilian satellites. The technical feasibility of this conversion has been demonstrated by both the United States and Russia, but further work is needed on the practical, economic and political aspects of this conversion.

Solutions to the problem of conversion, whether in the aerospace sector or any other sector, will, of course, require careful examination of the economics of con-

version. Clearly, priority should be given to identifying, developing and demonstrating conversion processes that can be market-driven.

It also seems clear, however, that some of the problems of conversion will not be solved by the market. There will undoubtedly be many cases where conversion will provide substantial general social and economic benefits, for example by maintaining employment, but where the conversion is not financially practicable in conventional market terms. Consideration needs to be given, therefore, to ways in which Governments can promote and support conversion while making maximum use of market forces.

The economic and technological problems of conversion are not going to be solved quickly or easily or by any one country on its own. Contributions by many people and organizations from many countries, both on the level of ideas and of practical demonstrations, will be required. International cooperation will be needed to ensure that solutions to these problems are available to all countries.

The General Assembly has called for a further strengthening of the effectiveness of the United Nations in maintaining international peace and security for all countries. As part of that effort, the United Nations will be encouraging and supporting disarmament and the conversion of military facilities to developmental use. Through the organization of meetings such as this international Conference, and through publication and dissemination of the results, the United Nations will promote international exchange of information and experience in conversion. The results of such meetings will also provide guidance to the United Nations for the organization of further activities in this field. The United Nations can also provide technical advice and support to countries in practical conversion projects and will work to bring interested countries and agencies together in cooperative efforts.

Ladies and Gentlemen, this Conference is dealing with a very complex and difficult topic. In the new international political and economic context, new and innovative approaches will be needed to meet the new opportunities and challenges. While there has already been much talk of conversion in a general sense, the time has come to move beyond general principles and to plan, develop and demonstrate practical ways and means for the conversion of specific military technologies. I am sure that the participants in this Conference, many of whom have had long experience in the applications of aerospace technology, will be providing valuable information and interesting new proposals. I hope that this Conference will provide a basis for real accomplishments in your countries and agencies, contributing to disarmament, security and development throughout the world.

Ladies and Gentlemen, I am very pleased to be able to address this important international Conference, and I look forward to seeing the results that emerge from your discussions.

IV. The Moscow Declaration, 1992

A. Preamble

As the nations of the world disengage from the cold war, the new international security environment requires them to reduce their military burdens and convert these scientific, technological, industrial and human resources to meet critical human needs. This process of conversion poses tremendous opportunities and challenges for the world community.

Demobilization provides an unparalleled opportunity for the international community to convert these resources to meet the most pressing environmental, social and economic problems now facing the peoples of the world. The challenge is to establish a comprehensive conversion process which will minimize the economic dislocation stemming from world-wide reductions in military spending, while maximizing the economic, social and environmental potential in civilian fields.

A verifiable disarmament process must accompany this conversion of military resources to ensure the security of all nations and to decrease the threat of proliferation and conflict.

We, the participants of the Conference, comprised of 467 people from 26 different nations, declare that the aerospace complex today constitutes one of the highest achievements of the world's scientific, technological and economic capabilities. The loss of this potential through military reductions without an appropriate conversion process will retard the world's scientific and technological progress and will produce negative consequences on a national and global scale.

The conferees believe that conversion of the aerospace complex must be based on a comprehensive strategy that considers political, economic, social and ecological implications. Successful conversion requires the coordinated efforts of national Governments and commercial enterprises, together with relevant scientists and experts. Advance conversion planning must be an integral part of the transition from inter-country military confrontation to a new global environment founded on scientific, technological and economic co-operation.

The participants of the Conference were unanimous in making the following recommendations:

B. Recommendations to the international community

1. Organizational and political issues

(*a*) ***Enhance United Nations conversion activities.*** We urge the United Nations to enhance considerably its conversion-related activities as a base of sustainable development. Particular attention should be paid to technology assessment, with a focus on dual-use technologies for civilian purposes. International bodies should face the challenge of advances in applications of aviation and space research to new products and services. Special opportunities exist for the least developed countries and for cooperation among all countries. The use of creative, cost-effective methods should be incorporated in a global network for education, training and other forms of sharing.

(*b*) ***Establish international, national and regional centres for aerospace-industry conversion.*** We urge that Member States consider the creation of a global centre for aerospace conversion and the establishment of national and regional centres for conversion of aerospace technology. Such centres could coordinate their activities by creating linked databases for exchange of information, providing institutional support for Member States, providing training and internships, encouraging national strategies, and making conversion achievement awards.

(*c*) ***Extend international agreements on limiting weapons proliferation and arms trade through conversion.*** Link verifiable disarmament agreements to an

orderly transfer of military resources and to prevention of proliferation of new military technologies, including space-based weapons and weapons of mass destruction. The industrialized countries should lead in establishing this process and should encourage others to join, recognizing that developing countries may have a special positive stake in, as well as special needs for, successful conversion.

(*d*) ***Extend training programmes.*** Organize international centres to train personnel, particularly managers of military enterprises, to orient them to the cost and quality controls required for non-military markets. Member States and international organizations are urged to promote appropriate training programmes and the exchange of experience in the conversion of aerospace technology for civilian purposes.

(*e*) ***Conduct continuous in-depth analysis of socio-economic processes that accompany conversion.*** Such analysis should include international public-opinion studies. The results of such studies may be used as input for comprehensive decision-making for conversion-related social policy.

2. Research and development issues

(*a*) ***Promote international and commercial scientific programmes including a global network for environmental monitoring and resource management.*** A major conversion opportunity could be created for aerospace technologies using the existing capabilities for a global network of environmental monitoring and resource management. In view of the outcome of the 1992 United Nations Conference on Environment and Development, it is essential that the environmental effects of man's activities on the Earth's atmosphere, oceans and land be monitored and controlled adequately. Advantage should be taken of the currently under-used capacity of existing space sectors for use in environmental monitoring, including remote sensing and performance of thorough business "due diligence" analyses to assess commercial capability. A meeting of experts should be convened to determine which international programmes could be used.

(*b*) ***Develop an international legal basis for protecting intellectual property rights for military conversion processes and products.*** Such development must pay due attention to the sensitive rights of sovereign-state secrecy requirements.

(*c*) ***Facilitate international trade.*** The restrictions established by the Coordinating Committee on Multilateral Export Controls and by national legislation, for example, should be restructured in favour of an international process to promote high-technology trade, while ensuring the control of dangerous weapons of mass destruction and dual-use technologies through internationally agreed regulations.

C. Recommendations to policy makers

1. ***Advance alternative-use planning as an essential process in the development of civilian products.*** Employees of military-industrial enterprises should be involved in alternative-use planning. Military-oriented businesses need assistance for retooling, reorganizing, financing and marketing products for commercial markets, market research (foreign and domestic), marketing strategies, sales forecasting, raising capital, developing quality-control techniques, and finding civilian export opportunities. Short-term tax incentives should also be considered to encourage conversion.

2. ***Undertake aerospace-industry conversion initiatives.*** Governmental initiatives for aerospace conversion should be directed towards infrastructure needs and environmental problems in countries in transition and in developing countries.

3. ***Extend benefits for the training of laid-off defence workers.*** Governments should provide specific unemployment benefits for workers laid off from defence plants. Government programmes should provide incentives to initiate early intervention programmes to prevent lay-offs. Where lay-offs are unavoidable, Governments should encourage defence contractors to enrol their workers in retraining and placement programmes prior to their being laid off.

4. ***Strengthen foundations for private investment in conversion.*** Multinational programmes that guarantee private investments for conversion projects in transitional economies against political risks such as expropriation should be expanded. Such countries might also create an international reserve fund under multinational trusteeship that could be used for settlement of disputes.

5. ***Support conversion databases.*** Data on successful conversion initiatives by aerospace companies, especially in new areas such as environmental clean-up, transport and communications, should be carefully studied and publicly disseminated.

6. ***Utilize excess military equipment for civilian applications.*** This should include exploring the use of rockets for civilian purposes, which may necessitate negotiations to lift restrictions on the use of military rockets for launch of non-military cargoes into space.

7. ***Support national controls to regulate defence and dual-use technologies.***

D. Recommendations to aerospace enterprises and commercial companies

1. ***Generate criteria for product engineering and development.*** Successful product engineering and development for non-military purposes must reflect industry-wide standards and the commercial criteria of cost-minimization, quality control and the design and production of reliable, safe, low-maintenance products.

2. ***Explore innovative forms of business collaboration.*** Examine new types of national and foreign participation in joint ventures, joint research facilities and information sharing. Also, consider various ownership arrangements, including worker and consumer ownership. Industrial incubators that can provide a home for the transition towards conversion of small and medium-sized enterprises are considered as particularly promising.

3. ***Develop and implement environmental criteria for new products.*** Carefully plan the use of materials, the management of waste and the evaluation of the effects of production processes on air, water and soil quality, as well as on the biosphere.

4. ***Develop non-governmental structures to finance aerospace conversion.*** This would include the use of profits from civilian sales.

V. Summary of proceedings

A. Opening session

The opening session was attended by senior host country officials representing the various organizing and sponsoring institutions. The Conference was inaugurated by Oleg Lobov, Chairman of the Expert Council to the President of the Russian Federation, and Chairman of the Organizing Committee. Opening statements were delivered by Georgy Chyzha, Deputy Prime Minister of the Russian Federation, Herbert Levin, Special Advisor to the Under-Secretary-General, Department of Economic and Social Development, United Nations, and Vladimir Petrovsky, Under-Secretary-General for Political Affairs, United Nations.

Conference greetings were received from the cosmonauts of the Mir space station in a videotaped presentation, the full text of which is included in annex II.

Joseph Ben-Dak, in his keynote address, said that it was fitting that the Conference had been held in the country that had led space research and that was now leading the peace effort. He gave voice to the hopes of the Conference when he stated that all nations would benefit from conversion. We were limited, he said, only by the imagination and innovation of scientists. Through peaceful uses of aerospace technology, global living standards could rise, along with sustainable development and growth of employment. Universities, however, must prepare engineers for the next generation. Their programmes in science and technology were in many cases obsolete. Interdisciplinary programmes in science and business must be introduced, and a connection established between government and science.

N. Jasentuliyana, in his keynote address, said that a central goal of United Nations activities in assisting countries in making the changes necessary was to determine ways in which conversion could be used as a vehicle for development. The nature of space technology lent itself to conversion for development purposes. Many current space systems such as satellites, launch vehicles and facilities and ground data receiving stations were already routinely used for both military and civilian purposes. Even in those countries where there was a clear distinction between military and civilian space programmes, the technology used for those efforts was largely the same. Conversion of military and other technologies to peaceful uses could take many forms. A number of military space systems such as launch vehicles and satellites could easily perform civilian functions with a minimum of modification. In other cases, a Government's choice of conversion policies would largely depend on international politics, national economic policies and private sector and consumer demand, as well as technological constraints.

There were numerous potential economic and national security problems that must be considered prior to policy implementation. The speaker examined some of these issues and offered several recommendations on how they might be resolved. The need for international cooperation in tackling these problems was stressed, especially in the steps that must be taken to ensure that the global economy has the capacity to absorb new production and to provide the political and economic stability that was an essential prerequisite to substantial private sector involvement. Such involvement was vital to finding market-oriented solutions to the problems of conversion. Providing solutions to the problems associated with conversion should become an integral goal of international economic and technical assistance programmes and serve as the foundation for private investment. The conversion of military industries to productive, peaceful uses was inherently an international problem that required international solution. The United Nations was determined to assist Governments and international organizations in that effort.

Valery Alaverdov, in his keynote address, said that for many years the "left-over" principle had been ap-

plied to the financing of civil space programmes and that military and sometimes political considerations had received the highest priority. It was the social and economic problems that were of highest priority in Russia today. For that reason, the main thrust in conversion of the space and rocket industry should be aimed at a reorientation towards the development and application of scientific research systems.

He indicated that 85 per cent of the space, scientific and industry potential was concentrated in Russia and that in 1989 military programmes accounted for more than two thirds of work being done in that field. In 1992 they constituted one half of the work and in 1993 the figure would fall to 44 per cent. Space related production should be concentrated in a limited number of leading industrial enterprises where conversion could be achieved by employing 75 per cent of the military-industrial potential in civilian and scientific space application projects. The other 25 per cent of production potential would be used for introducing high-technology and space methods into non-military production, thereby allowing participation in market economies.

The speaker pointed out that in Russia, future development of space science and technology was discussed openly with the active participation of mass-media representatives, which heightened the assuredness that decisions taken and priorities determined were correct. Even more important for Russia had been the adoption of the "Law on Space Activities in the Russian Federation", which was now undergoing final drafting. In addition, he said that special attention had been given to promoting international cooperation through the outstanding achievements of Russian cosmonauts. In 1992, two implementing agreements were signed between the Russian Space Agency of the Russian Federation and the National Aeronautics and Space Administration (NASA) of the United States of America. One of the agreements concerned cooperation in manned space flight, notably, NASA's participation in the Russian "Mars-94" project. In accordance with the agreement between the Russian Space Agency and the National Centre for Space Research of France, four flights of French cosmonauts would be carried out to the Mir space station and joint research would be conducted in connection with the "Bion-92", "Interball", "Mars-94/96" and "Meteor-3" programmes. There were plans to extend international cooperation efforts with governmental and space agencies in Germany, Japan and Italy, and with the European Space Agency. There was also an agreement on joint work in space research and use between the countries of the Commonwealth of Independent States (CIS), conducted through intergovernmental programmes.

B. Session I

Aerospace technology and conversion: dreams and reality

Seymour Melman, Chairman, addressed strategic factors in economic conversion and identified 10 characteristics that were crucial for efficient conversion operations: (*a*) mandatory labour management alternative-use committees in military-serving factories, bases and laboratories; (*b*) conversion planned well in advance of actual operations; (*c*) advance (one year) notification of military contract cancellations; (*d*) mandatory occupational retraining, particularly for managers and engineers with military experience; (*e*) community conversion planning, especially in locations with concentrations of military-serving work; (*f*) decentralized control of alternative-use planning; (*g*) income maintenance during conversion operations; (*h*) relocation allowances for employees of military-serving facilities; (*i*) a national network for employment opportunity; and (*j*) government (national, local) capital investment planning for infrastructure.

The Chairman described the development and characteristics of a model American aerospace enterprise—"United Aerospace"—a competitive venture whose characteristics were reflected in aerospace industry firms. He also illustrated the case of Boeing-Vertol, an attempt by an experienced producer of military helicopters to build marketable electric trolleys (light rail vehicles) and subway cars. A series of technical, design and production failures had resulted in the termination of the project. Similar patterns of technico-economic failure had appeared in the San Francisco BART (rail) project of the Roler Corporation and in the attempt by a German corporation to build passenger buses.

These experiences did not reflect a failure of economic conversion. Rather, they defined the consequences of a failure to carry out conversion. The main areas of failure included: (*a*) product design of unnecessary complexity and refinement; (*b*) the absence of specific design features to ensure simplicity, reliability and ease of maintenance; (*c*) inadequate testing of complete prototype vehicles before final production; (*d*) the absence of reliability and failure-rate information needed for operating an efficient spare parts inventory; and (*e*) customers forced to deal with 17 sources for spare parts, with varied lead-times.

Joseph Ben-Dak raised the prickly issue that the

military wished to maintain a higher level of technological development than was needed by civilian society; that such a technological focus was wasteful and that it robbed resources, particularly from the developing world. Russia, while having superior technology, was being denied markets by the Western nations. He emphasized that Russia would not be pushed backwards to the status of a developing nation.

He stated that military-industrial complexes worldwide were in love with weapons technology and wanted to maintain their production monopoly. The civilian market for such technology was small. Some elements in the West wanted to shut Russia out of whatever market there was. The danger was that though the cold war was over, new ways would be found to continue pouring money into military technology. That danger was shared by East and West alike.

John Rosati addressed the down-sizing of the aerospace industry which had resulted in a large number of scientists, engineers, technicians, instrumentation, information processing, and systems engineering becoming available for important non-aerospace areas of concern, such as transport, energy production, and environmental quality. Concurrently, the developing countries of the world were searching for ways to advance their quality of life through developments made possible by, and in collaboration with, those high-technology aerospace personnel and their capabilities in such areas as communication, navigation, transport, environmental monitoring and control, aviation, and other high-value-added business sectors.

To be successful, the conversion of aerospace technology should be guided by a procedure which involved all aspects of the process—not just the apparent suitability from a technological point of view. Four primary factors must be satisfactorily addressed in order to ensure the successful transition of high technology: (*a*) the status of the technology and plans for its evolution; (*b*) the economics of the industry concerned in relation to the overall conversion process; (*c*) marketing assessment and planning to ensure that commercial expectations were realistic and consistent with long-term business objectives for such non-aerospace applications; and (*d*) financing of entrepreneurial ventures.

When analysed in greater detail, the business "dual-diligence" approach consisted of many of the following steps: technology analysis, product analysis, strategic risk assessment, competitive analysis, market strategy, industry and market segment analysis, and financial analysis. Having performed those analyses, one must then determine if there was an adequate organizational infrastructure or identify the infrastructure required. Then, and only then, should one proceed with the optimization process to select the most appropriate strategy and solutions. It should be understood by decision makers at all levels in the private sectors of aerospace and by their public policy counterparts that the achievement of successful conversion of human, capital, and technological aerospace assets in a timely and efficient manner required an unprecedented mode of collaboration involving numerous competing interests. To accomplish the overall goal of successful technology conversion and transfer to non-aerospace purposes, public policies must be harmonized with enterprise objectives that were defined in terms of measurable efficiency, value-added and profitability. Additionally and uniquely significant was the imperative to cooperate with new enterprises that represented the growing ambitions of newly competitive nations. Those new players should not only be encouraged to enter the competition, but new mechanisms for collaboration should be fashioned that would maximize the potential benefits for all.

Ksenia Gonchar presented new models of interaction between military and civilian technological cultures and pointed out that the immediate results of defence conversion in Russia, however inspiring, had turned out to be less than expected. Decades of subordination of general technological strategy to the rules of military confrontation had resulted not only in the downgrading of civilian technologies and industries but had also led to a critical disjunction of the aims, principles, organizational structure and technological and business culture between civilian and defence spheres. Those gaps appeared to have created the most important barriers to the efficient use of ideas, materials and products developed from military technology.

When the various traditional interactions between military and civilian technological systems were analysed, the modest input of military technologies to civilian products did not compensate for the vast technological and economic losses from the suppression of the civilian base. Major changes were needed in respect of obsolete priorities and institutes, especially in relation to transformations in the nature of civilian and military innovations. Defence policy should no longer replace technological and industrial policy. Integration of defence and civilian technological systems aimed mainly at the priorities of the consumer market might begin in the short-run with the elimination of obstacles to the free spread of non-sensitive technologies (excessive secrecy, separate standards and information systems in particular), establishment of a proper legal base and the creation of institutes to stimulate defence technology conversion.

Gennady Osipov said that if the negative components of the sociopolitical consequences of conversion overbalanced the positive ones, Russian society would meet marginalization and poverty of an important part of the able-bodied population, and that there would be a spread of radical political changes which could find their social basis in the so-called "sacrifices" of conversion. Decisions taken by government bodies for implementing conversion of the Russian aerospace complex reflected to a large measure the sociopolitical background that had been formed under the influence of social mytho-creation during the periods of reconstruction and post-reconstruction. The myth concerned the immediate effect of the conversion process and the needlessness of developing the Russian aerospace complex at the present time.

According to the speaker, two different approaches had been tested in conversion policy, "physical" and "economic". In the framework of "physical conversion" in Russia, it was presumed that about 30 per cent of military production would be conserved and that the remaining defensive enterprises would change their profile directly for civilian aims. The first favourable results could be expected in 2-3 years, with an appreciable effect in 5-6 years. The speaker concluded that the objectives of the "physical conversion" between 1988-1991 had failed, that the Russian economy had derived no benefit from it, and that in the long run the sociopolitical climate had worsened sharply.

A conceptual change would reject instantaneous "physical conversion" and approve progressive "economic conversion". The current profile of defensive enterprises placed emphasis on the sale of military production, mainly abroad, and mandated that all revenues be directed for financing and ensuring "physical conversion". That was a technocratic approach that did not appreciate the logic of the sociopolitical development of the international community and Russia as a whole, which was fraught with a number of problems of a geopolitical and economic character.

However, the international community had not yet created the mechanisms for military-political security. The military policy of Russia was still evolving. Any rash steps without qualified sociopolitical expertise could harm and destabilize the global situation as well as Russian society.

V. S. Arunachalam said that military-industrial complexes of the former Soviet Union had operated under hierarchical control, with design bureaux working as research and development entities during the development phase, and as production industries during production. That system had ensured a smooth transition from research to development, testing and production. A vertically integrated command control system ensured that materials, systems and components were available for production. The captive buyer provided a ready market. However, when civilian products replaced military products, the chain of command broke down, throwing the system into confusion. Industries, in their eagerness to diversify, opted for products which they presumed the consumer needed and which they could manufacture, while laboratories and design bureaux were left out of the process. That had resulted in sub-optimal products, unrealistic costs, and sagging morale among outstanding scientists, engineers and workers.

It was therefore necessary, he said, to substitute command-control with cooperative linkages, and orders with agreements, which would enable a three-part programme organization with representation from policy, programme and production levels. Areas should be chosen with short-term and long-range goals. Immediate short-term goals included participation at the contractor or sub-contractor level in ongoing programmes in civil aviation, and in international programmes dealing with aging aircraft, the introduction of aluminium-lithium alloys for civil aircraft, and the modernization of landing systems. Long-range programmes could include the development of inducted fan engines. Such programmes would not only keep laboratories and design bureaux alive and active but would provide the necessary resources for their modernization in areas of interest. Industrial participation in those and other production plans would also help to ensure their effectiveness. There would be a need for a clear definition of objectives and an evolution of cooperation among all participants of the aerospace industry, which he believed was desirable and possible.

Herbert Wulf discussed the factors that had contributed to the constraints being experienced by the arms industry. First, the changed political climate in Europe, culminating in the dismantlement of the Warsaw Treaty Organization and the collapse of the Soviet Union, had led to entirely changed threat perceptions. Secondly, financial constraints: in the more benign security environment, military budgets had fallen in real terms. Thirdly, reduced possibilities for exports: expanding exports did not provide a practicable alternative for the arms industry. Changing international market conditions were making it more difficult to expand exports. The consequences were shrinking arms sales, loss of jobs, and reduced profit opportunities. However, there were also developments in opposite directions. A number of countries were even expanding their industrial arms base.

The speaker concluded that, first, expansion and reduction of arms production facilities were taking place simultaneously, which would not only intensify competition in a shrinking market but also increase pressure to slow the pace of the disarmament process. Secondly, the trend of reduced arms production was not a result of a conscious disarmament policy but primarily the consequence of the reality of financial constraints and economic crises. And thirdly, that while conversion was a method to cushion some of the social and economic problems resulting from disarmament, not all arms production facilities could be converted; a number of companies would have to close.

C. Session II

Policy, security and legal issues

Rainer W. Rupp pointed out that, as in the West, a painful adaptation of the industrial structure to a reduced and changed demand was inevitable. Export growth of military aerospace equipment could only provide temporary relief. That was particularly true for Russia, where the cuts were most severe and where conversion was complicated by the transformation of the centrally planned economy to a market system.

The speaker implied that the results of extensive sectoral analyses and case-studies in the West that had focused in particular on the aerospace industries of the United States and Germany had been used to assess the conversion potential of the Russian aerospace sector. In the West, for a number of reasons, the conversion of military to civil-oriented production "at the factory level" had received inadequate support from company executives and government authorities alike. A number of those reasons did not apply, however, in the East. In the West, for instance, saturated civilian markets made it hard for military producers to find a niche for their civilian products. By contrast, in the East, military aerospace was ahead of civilian aerospace and the chances for an internal technology transfer for civilian use were much better than in the West. Moreover, there was a huge potential domestic demand for better civilian planes.

In view of the sheer size of the necessary industrial adjustment and restructuring in the East, any conversion policy that narrowly focused on the factory level of existing companies was bound to fail. In the past, the Soviet industrial structure had prevented the development of a broad spectrum of increasingly specialized small and medium-sized enterprises (SMEs) in Russia. In the West, SMEs (as sub-contractors more often than not) were producing sophisticated dual-use technology products for civilian and/or military use. In Russia, potential SMEs were locked inside huge industrial conglomerates, where they were often strangled by bureaucracy and condemned to inefficiency.

Finally, the speaker suggested that a main task of conversion would be to break SMEs out of the conglomerates and, with the help of a mix of regional and structural policies, transform them into independently operating dual-use, high-technology companies. While they would remain capable of fulfilling their commitments to the main defence contractors, they would increasingly find their most profitable markets in the civilian sector.

John Tepper Marlin presented a paper written jointly with ***Jürgen Brauer***. In reviewing global military spending trends, the authors said that between 1980 and 1989 the United States share rose from 22 to 28 per cent. Based on modest assumptions of developments in the former Warsaw Pact nations, the North Atlantic Treaty Organization allies, developing nations, and the Bush Administration's defence budget proposals, the authors projected that the United States share of world military spending could rise to 45 per cent by 1997.

It was pointed out that the most common response of West European and United States military contractors to proposals for military spending cuts was to protect the financial assets and standing of the contractor, rather than the economic future of workers and communities. In practice, that trend was manifested by various mergers and industrial portfolio diversification efforts, rather than a search for new, non-military markets or an emphasis on retraining and worker retention. In the United States, unlike many Western European nations, the merits and demerits of "industrial policy" had been hotly debated. The speaker reviewed the discussion with respect to the military-industrial sector and the link to defence-dependent communities, and proposed a number of guidelines for local community response to military-spending cuts, including community organization, economic development and community diversification programmes, and early warning and community assistance programmes for companies and workers.

Federal conversion legislation in the United States had been irresolute and beset by major disagreements between the United States Congress and the Bush Administration. When laws were passed, they were implemented with extreme slowness. The Bush Administration had no defence-conversion initiatives prior to its campaign programme in May 1992. Instead, it persistently blocked congressional conversion initiatives. The speaker reviewed the history of the debate and concluded with a series of specific conversion-

related recommendations to the next United States President, including a suggestion to convene the existing Economic Adjustment Committee at cabinet-level to deal with the formidable local, regional, national and international adjustment problems posed by conversion.

Aerospace was a major technology-driven sector in such areas as materials science, aircraft engine development and aerodynamics. The industry's conversion might well set a critical example for other industries (motor vehicle manufacture, shipbuilding, chemicals and explosives, biotechnology, materials technology and informatics). The speaker ended his presentation by proposing a number of specific conversion recommendations to national Governments and the international community. Those recommendations had formed the basis of *The Moscow Declaration, 1992*, of the Conference.

Victor Danilov-Daniljian discussed ecology and conversion and said that aviation and cosmonautics contributed to environmental contamination, mainly in respect of the combustion products of aviation fuel and the unburnt toxic components of rocket fuel. Those pollutants caused a number of phenomena such as air and ground surface contamination, changes in atmospheric thermal balance, and destruction of the Earth's ozone layer. In addition, aviation and rocket technology had contributed to disturbances in the ionosphere and higher atmospheric layers and to the accumulation of orbital "rubbish", as well as creating certain hyperacoustic effects.

One of the most important trends in solving ecological problems through conversion of the aerospace complex involved the use of aerospace systems to monitor and control ecological conditions. The first radical step towards real conversion would be the gradual removal of national restrictions on access to military aerospace information and, to that end, progress had already been made. In August 1992, the Russian Government decided to allow the use of satellite pictures with a linear resolution of up to 2 metres for civilian purposes. The aerospace industry could also contribute towards the creation of a national geo-information system—a concept which was in the process of being developed; such a system could be integrated into a future global geo-information system. The main problem of exploiting civilian earth-surveying systems lay in the imperfection of the on-board facilities, as well as in the limited development of ground infrastructure and signal processing techniques for multi-dimensional information that permitted identification and quantitative evaluation of anthropogenic influences on the environment.

It was necessary to solve the acute problems associated with the technical and technological reorganization of enterprises, and to ensure that comprehensive solutions to ecological problems would comprise an integral part of such reorganization. Consequently, in 1992, the Ministry of Ecology and Natural Resources of the Russian Federation had developed a special state programme entitled "Conversion for ecology". As part of the overall conversion of the defence complex, including the aerospace industry, the programme represented a first step in the utilization of defence technologies in the area of environmental protection. Approximately one third of the engineers working on the programme were from aerospace companies.

The main task of the programme was to develop and create products that would reduce anthropogenic loading on the environment and improve the ecological state. The programme included: (*a*) development of full-scale production, using new technologies, for purification of exhaust gases and waste water, and for handling and recycling solid wastes; (*b*) development and creation of information systems for control of industrial areas and pollution sources; (*c*) development of methods to restore ecosystems damaged by economic and military activity; (*d*) development of new and renewable sources of energy, environmentally clean technologies, and energy-saving production technologies; and (*e*) development of information on and technologies for rational and environmentally sound exploitation of marine resources.

The speaker emphasised that the Ministry of Ecology and Natural Resources was open to cooperation in various forms and was ready to assist aerospace industries in Russia and abroad.

Lloyd (Jeff) Dumas addressed the "great divide" between the military and civilian aerospace industries. Military industry was performance-driven, cost-insensitive, and government-oriented, while civilian industry was much more cost-sensitive and operated largely in a competitive, private-sector marketplace. With the right kind of preparation and planning, engineers, scientists and managers could be retrained and re-oriented and facilities retooled and restructured to cross that "great divide" and to function efficiently in a civilian marketplace. The flattening of hierarchical management structures should also be most helpful in increasing efficiency. The worker-owned and managed industrial cooperatives of Mondragon in Spain represented cost-effective industrial concerns with very flat managerial organizations which could serve as useful models for small to medium-sized aerospace enterprises, especially those in Eastern Europe and the former Soviet

Union. Strategies for both "internal conversion" (within the existing military firm) and "external conversion" (reconnecting labour and facilities released from military sector firms to productive civilian work in other enterprises) were discussed.

Jürgen Scheffran said that the end of the cold war had created a new and radically transformed environment for arms production and trade. Nevertheless, over-capacities existed, not only in defence-related production but in military research and development as well. Three major strategies to deal with that situation could be envisaged: first, deep reductions in military arsenals and conversion of the defence industries of the major military powers; secondly, the qualitative modernization of military arsenals by further enforcing the development and production of high-technology weapons at lower quantitative levels and applying dual-use strategies; and thirdly, the question of exports of armaments and related technologies, in particular to developing countries.

After a peak in world-wide arms trade in the late 1980s, there had been a continued downward trend in the aggregate value of the arms trade after 1987. Increasingly, arms trade combined sales of finished defence systems with the transfer of the underlying scientific, technological and industrial infrastructure necessary for indigenous development and production. The transfer of dual-use aerospace technologies, components, production facilities and know-how could be used to build delivery capabilities for weapons of mass destruction. Effective controls of missile technology flow were complicated by the technical overlap between ballistic missiles and civilian space launchers. The possession and use of ballistic missiles could destabilize the strategic situation substantially, in particular if they were long-range, highly accurate and cheap. With the exception of China, however, no third world country currently possessed ballistic missiles of intercontinental range, which were difficult to develop and produce because of their inherent complexity. Compared to missiles, combat aircraft were widely distributed across the globe.

If the long-term problem of missile proliferation could not be resolved by political means, military reactions were possible by the major Northern Powers, in particular, the build-up of missile defence systems such as the Global Protection Against Limited Strikes as part of the Strategic Defence Initiative of the United States. Accidental or unauthorized strikes from the former Soviet republics or potential third world missile threats did not justify the very large expenditures, potential risks and instabilities, or the diversion of resources that deployment of such defence systems would require. As an alternative, Governments should strengthen the Anti-ballistic Missile Treaty by clarification of terms, should work towards an international ban on space weapons and should negotiate cooperative political measures to improve export controls, arms control and disarmament.

Although the Missile Technology Control Regime had come too late to stop the spread of short-range delivery systems, it had been effective in focusing political support on missile non-proliferation and in slowing down the spread of missiles. Because of several shortcomings, partly owing to the discriminatory character of the Control Regime and its orientation towards supply-side control, demand-side approaches should be chosen that would deal with incentives for missile proliferation on a non-discriminatory basis. A global ban on ballistic missiles should be considered as one option. To resolve verification problems owing to the difficulty of distinguishing between civilian space launchers and ballistic missiles, international cooperative measures of confidence-building, monitoring and inspection would be required, combined with international aerospace cooperation and technology transfer.

Angelo Airaghi pointed out that recent international events had upset all the defence industry development models. Figures showed that the market as a whole had shrunk, and that had certainly affected the aircraft industry. However, defence electronics did not appear to have suffered so far. To counter the consequent excess of capacity, companies had adopted two basic response strategies: the first was to concentrate on the creation of national "champions", including international integration of companies; the second was based on conversion and diversification. In Western countries, successful examples of conversion from military to non-military production were extremely rare to date.

Opting for the so-called "dual-use" was, at first sight, the most straightforward approach, but even in that case the number of failures was very high. The best choice for a company operating in a free market appeared to be a gradual change in its product mix, to introduce non-military production side by side with its declining military production but keep its organization and management essentially separate. (In countries formerly operating under centrally planned economies, however, the best choice might well be the opposite.) The twofold approach had also stimulated East-West cooperation. The opportunity to draw on the considerable technological potential of Eastern Europe, coupled with its low labour costs, had led to numerous ventures between Western companies and ex-Soviet organizations.

In connection with North-South cooperation, Southern countries had basically assumed the role of customers. A decrease in those countries' spending capacities or in their willingness to remain in that role could be used to redefine reciprocal relations, to the benefit of both partners. One possibility lay in actions aimed at improving the living conditions in some of the world's poorest areas. The complexity and enormity of the problems called for managerial and logistical skills of a dimension such as was currently only found in military programmes.

The speaker gave a number of examples in support of those statements. First, regarding diversification, the Finmeccanica aerospace activities had always covered military and civilian sectors, drawing on a common technological base. In the shift from the military segment, the demand trend had certainly helped. Positive results in diversification had been experienced in the environmental sector, especially with respect to territorial monitoring and telecommunications. Secondly, regarding conversion through cooperation, the speaker presented a number of Russian examples: (*a*) NIITOP, the Technological Research Institute, had produced ultrasonic medical equipment, in particular, echographs for medical diagnosis, using technology developed by Esaote, a member of the Finmeccanica Group; (*b*) Fata, an engineering company connected to Finmeccanica, owned a minority share of Sovietalprodmash, a venture that was utilizing a factory in Volskh, the Mari Republic, that had previously been used for military production; when running at full capacity, it would produce 153,000 refrigerated cabinets and 70,000 refrigerated cells a year; and (*c*) a joint venture for air traffic control systems, called Buran, was formed by Alenia-Finmeccanica (which held 49 per cent of the shares) and five Russian concerns. The primary aim of that venture was to satisfy the needs of the CIS market, which should radically reorganize its air transport system. In addition to modernizing those systems, Buran also planned to supply third-world countries.

Jury Jashin said that the theoretical idea of conversion was to transfer a "closed" information system (the defence aerospace complex before conversion) to a more accessible one. There were two methods: first, divide the former large, closed system into smaller segments; secondly, widen the function and organization of the former system and adapt to current circumstances. However, uncontrolled distribution of information could have various effects such as (*a*) brain drain, (*b*) the sale of modern weapons and technologies, (*c*) commercialization of scientific and research work, and (*d*) breach of information copyright. Negative effects from a national point of view included (*a*) economic loss to the owners of information caused by the theft of defence technologies, (*b*) a general decrease in export potential, and (*c*) destabilizing changes in local and global military-strategic partnerships.

Consequently, it was most important to establish a security system for information. In Russia, the absence of laws for the protection of intellectual property and the security of commercial information had created a complicated situation: firstly, Russia was not on an equal footing with countries where the problems of information security had been solved through the aforementioned Coordinating Committee on Multilateral Export Controls; secondly, Russia could become the "information leak" region, especially in the area of potentially dangerous "dual-use" technologies. Both factors could sharply decrease the expected benefits of conversion of the Russian aerospace complex. Therefore, it was equally important, especially in Russia, to develop legal measures for free information distribution.

The speaker discussed the current state of the diversification process at enterprises and scientific centres in relation to their methods of information retrieval. The centres were inevitably at the crossroads of two information flows—one closed and one open—connected to widely accessible scientific-industrial activities. Hardware modifications that were sometimes carried out to achieve instant profit could result in non-sanctioned access to closed information networks.

Therefore, the conversion of the aerospace complex had created a serious technical problem—the provision of security during the informatization process. The reorientation of scientific and technical potential towards the civilian sector would be reflected in the growth of international scientific and technical information exchange. The negative factor holding back such growth was the "prohibition" approach to information exchange. The optimal method for solving the problem appeared to be in determining the *level* of prohibition.

Finally, it was necessary to promote international cooperation and to develop common approaches for controlling the conversion process, including a system of international law that would provide information security in respect of the advanced technologies of the defence industries. The objectives should be to (*a*) remove barriers to the exchange of production and technology, (*b*) contribute to the creation of a new world *law* order and to the stabilization of "hot points", and (*c*) open a new page in relations between "former enemies" by expanding the sphere of cooperation on confidential matters.

In order to reach those objectives, the speaker proposed the following: (*a*) identification of proprietary products and technologies that could only be exported to a limited number of countries; (*b*) the appointment of an international body to determine the potential danger of new technologies; (*c*) mutual reconsideration of all current bans on the international exchange of production, technology and information that were the legacy of the cold war; (*d*) bilateral and multipartite agreements on rules governing the use of intelligence information, and on implementing a system of mutual control; (*e*) an agreement on the use of aerospace information for enhancing economic and social development worldwide, particularly in developing countries; and (*f*) preparation of an international conference under United Nations guidance to examine the methods and principles of information security.

Manfred Bethin discussed the need for management training to support the restructuring of the military-industrial complex of the Russian Federation. He pointed out that measures to support the conversion process in Russia must include emergency packages, consultancy, and transfer of practical knowledge on the mechanisms and administration of a market economy and its institutions. The goal was to accelerate the integration of the Russian Federation into the world economy.

The development and implementation of training programmes were a top priority. A special management retraining programme had been developed at the University of Dortmund to support the restructuring of the military-industrial complex of the Russian Federation. The programme could be incorporated within the European Community programme of technical aid for Russia. Its aim was to facilitate the transition to a market economy of the industrial sectors and regions that play a key role in the reform process. It was of vital importance that the arms industry, which still dominated the Russian economy, was rapidly and most efficiently put into a position to meet the new and urgent tasks of a modern industrial state.

The University of Dortmund planned to organize a crash course, using modern teaching methods, for selected executives from companies of the military-industrial complex; the course would cover marketing, economics, finance, personnel management, organizational psychology and control; special emphasis would be placed on environmental management. In a follow-up phase, the course would include visits to leading German and West European companies. In-house training on selected subjects would be provided to specific occupational groups, rather than restricted to a few managers. The emphasis of the training concept would be on basic environmental aspects in the areas of business administration, materials management and logistics. Such an approach was essential in view of the vast number of environment-related tasks currently confronting Russia. The aim would be to provide the participants with the expertise necessary for addressing the various problems they would encounter in the area of environmental protection. Ecological aspects that took into account the increasing importance of the protection of the environment by industry had been integrated into the course curriculum.

D. Session III

Country case-studies on the conversion of aerospace companies

Shi Chang Jie, the first speaker, said that towards the end of the 1970s, the Chinese Government had begun to issue directives to relevant ministries regarding the conversion of a part of their operations from military to civilian production. Many aerospace enterprises had acted accordingly since the early 1980s and considerable progress had been made. Beginning in 1988, the Ministry of Aerospace Industry had made conversion a set policy, and the pace had accelerated. After successfully fulfilling its responsibility for the development of aerospace technologies, the Ministry had been actively engaged in transferring those technologies to various civilian applications.

The policy of "conversion for development" had been adopted at a time when expenditures for aerospace activities in China were not excessive, nor had there been any indication of national economic difficulty. Hence, the decision to convert aerospace technologies to civilian applications had been based entirely on the need to accelerate national economic construction and modernization.

The speaker pointed out three aspects of conversion in China: (*a*) the utilization of aerospace facilities for the development and production of civilian products; (*b*) the transfer of aerospace technologies to civilian applications; and (*c*) the promotion of civilian applications of satellite technology. Particular emphasis had been given to the latter aspect, including: (*a*) applications in the area of communications, meteorology and remote sensing; and (*b*) suggestions for international cooperation.

Jörg Huffschmid presented Germany's experience in conversion of the aerospace industry and said that corporations facing a steady decline in military procurement orders had in general two strategic options. Their policy could be (*a*) expansionist (more exports,

national concentration on international acquisitions), or (*b*) reductionist (selling off, laying off, diversification, conversion). The German aerospace industry had chosen the first option. In a series of subsequent takeovers, the Daimler-Benz Corporation bought all of the major producers in the aircraft industry (systems, engines, electronic equipment) and in the space sector. The Daimler-Benz subsidiary—Daimler-Benz Luft und Raumfahrt-Holding—was the national champion of the German aerospace industry.

In comparison to those strategic measures, conversion efforts had remained very modest. As a result of the one-sided corporate strategy, the industry had encountered various problems following the recent cancellation of major military projects; the most significant problems were those of diseconomies of scope and of X-inefficiencies of the new concern. A particular bottleneck for efficient conversion appeared to be the inaptitude of management in discovering and opening up commercial markets.

The speaker's conclusions were that: (*a*) there should be very clear government decisions to provide orientation for corporate strategies; (*b*) the strategy of concentration and international mergers was a risky one, and that decentralization seemed preferable; (*c*) the traditional procurement mechanism was not conducive to conversion and should be broken up; (*d*) conversion should be planned for, particularly at the management level (retraining); and (*e*) government support could be given on a central level (conversion funds) as well as on regional and local levels, where conversion should be integrated into regional development policy.

Lauro Fortes presented a number of alternatives for coping with the scarcity of resources for the Brazilian space programme. Space activities in Brazil had been affected, both directly and indirectly, by the international process of arms control, disarmament and defence spending cuts, as well as by the country's recession and the resulting retraction of government investment in research and development. That whole process was likely to have further and deeper consequences for the Brazilian space sector. However, by exercising ingenuity and relying on international understanding and increased cooperation, the country might be able to overcome its current difficulties and emerge with feasible alternatives for its future space activities. Such alternatives should combine two important attributes: (*a*) they should represent attractive possibilities from both domestic and international standpoints; and (*b*) they should adjust to relatively modest government budgets.

The author also presented an overview of Brazilian space activities, a brief analysis of the current phase of transition, and preliminary ideas on possible future initiatives that might satisfy the desirable conditions stated above.

Rakesh Sood, in presenting the Indian experience, pointed out that conversion for development and the consequent economic readjustment were among the most challenging issues facing the international community during the 1990s. The end of the cold war had brought about a reassessment of security in the context of East-West relations which would eventually lead to diminishing defence and procurement budgets. However, in other regions, security reassessments would depend on political developments intrinsic to a particular region.

The economic imperatives in those regions had necessitated a lesser degree of insulation of the defence sector from the civilian sector and would consequently allow for a smoother transition, depending on security reassessment. An example was the 400 per cent increase in sales to the civilian sector from the ordnance factories from 1988/89 to 1990/91; another example was the fact that 41 per cent of the production of the eight defence public-sector undertakings had gone to civilian industry.

The high interaction of civilian industry with the space programme was reflected in an increase of funds from the space programme to industry and to specific technology transfers. Nevertheless, restrictions on international resources would increase the need to find new interfaces between civil and military industry. Protectionism and the institution of ad-hoc export control regimes would, however, have a negative effect on conversion and make integration into the global market system more difficult.

Andrei Kokoschin presented his perspectives on how ongoing efforts to make the transition from a centrally planned to a market economy in Russia had affected conversion of the aerospace industry. In that context, the space industry had been unwilling to reorient its activities exclusively towards the production of consumer goods, preferring rather to widen its sphere of activity to other civilian uses and the promotion of dual-purpose technologies that favoured both the defence of the armed forces and the national economy.

The speaker outlined the probable directions of conversion and presented possible areas of application, including the deployment of civilian space vehicles to provide data for agriculture, disaster-prevention and meteorological forecasting, and the wide range of possibilities of deployment of advanced solar and chemical batteries and sensors. Such activities would also stimu-

late the development of new technology materials, optics and instruments. The speaker noted that implementation of such innovations and the application of new technologies to non-military areas of Russian society had suffered from a lack of incentives, but that current initiatives were providing productive opportunities. Moreover, the provision of information and services to other CIS countries, regions and firms interested in space programmes was being considered.

Other potential applications of space technologies could result from the use of remote-sensing techniques in the areas of geology, hydrology and dendrology, and from the deployment of satellites with photo, electro-optical and other types of sensors. The use of existing reconnaissance satellite technology for civilian purposes might require substantial resources for adoption, apart from its use in ecological monitoring.

The speaker suggested a number of channels that would facilitate cooperation or "networking" between the space programme and the new process and product-users or end-users in non-military sectors. He also discussed crucial problems and obstacles associated with the process of converting aerospace technologies to civilian use, including: (*a*) the high cost of research and development; (*b*) the need for significant financial resources for retraining; and (*c*) political problems arising from the need to refurnish and convert missiles on an inter-state level at sites outside of Russia. Finally, he discussed the legal and financial problems associated with "productive" structures and the military complex, and made several specific proposals regarding possible international cooperation in the area of aircraft production.

Nicolai Petrakov said that the economies of Russia and the other former Soviet republics were facing a deep crisis with growing inflation, a steep drop in industrial production, a disorganized monetary system, disintegration of the "ruble zone", economic wars between the central banks, and the inability of the Russian Government and its central bank to establish a realistic exchange rate for the ruble against convertible currencies. Moreover, the absence of stable legal frameworks and economic conditions prevented the private sector from developing and competing with state enterprises. The Government appeared to be apathetic and helpless in its efforts to stimulate foreign investments in Russia. Therefore, the only way out of the current difficulties would be to develop a market economy that was integrated with the global economic system.

Russian exports had fallen by 35 per cent in the first half of 1992 compared to the first half of 1991, owing to the continuing decline in the volume of production in the main sectors of the economy and to disruptions in the transportation systems. Russian imports in the first half of 1992 had fallen by 24 per cent compared to the first half of 1991, owing to the general decline of investment activity and to the sharply reduced volume of new capital investment in the country. The foreign debt of the Russian Federation as of 1 June 1992 was $74.3 billion.

In view of those circumstances, the speaker indicated a number of areas where joint efforts by Russian and Western experts would be beneficial: (*a*) the upgrading of Russian foreign investment legislation in line with international standards and the establishment of a system of economic preferences for foreign investors to compensate for political risks; (*b*) the participation of Western investors in the promotion of Russian-made goods for foreign markets; (*c*) the development of international programmes to support private sector development through direct business contacts with representatives of non-governmental organizations (the Leasers' Union, the Farmers' Union, the Association of Private Entrepreneurs, for example); (*d*) the economic development of the settlement zones occupied by Russian refugees from other ex-Soviet republics (the "ecologically clean" and sparsely populated Pskov-Kostroma line, for example); (*e*) the reconstruction of economic links between the CIS and countries of Eastern Europe; (*f*) the integration of Russia and other CIS countries into the international monetary system; and (*g*) the establishment of an East European Payments Union and the coordination of its monetary policies with those of the European Community.

Gregory Bischak presented a paper written jointly with ***James Raffel*** which examined conversion experiences in the United States of America. The speaker pointed out that economic conversion referred to the process of moving labour, capital and other resources from military uses to relevant civilian applications. One of the primary roles of government in the process was to establish policies that would facilitate conversion through advance planning and technical assistance, so as to minimize the economic dislocation resulting from the reduction in military spending.

Fiscal conversion referred to economic policies necessary to cushion the economy from the shocks of the military "wind-down" by stimulating the overall level of economic activity. Three fiscal-policy approaches were possible: (*a*) a shift of government budget priorities from military to civilian programmes which left the overall level of government spending intact; (*b*) a shift in government priorities coupled with deficit finance to stimulate the overall level of employment and output during the transition process; and (*c*) a free market adjustment approach that allowed the

level of government spending to fall through reductions in military spending. Experience in the United States throughout the various military wind-downs following the Second World War indicated that the first two options had been used by policy makers to make adjustments at the macroeconomic level.

Structural conversion policies referred to policies that aimed to provide targeted assistance at the industrial, regional and occupational levels to minimize the economic repercussions on firms, communities and workers. Such assistance usually entailed retraining for workers, assistance to communities and firms and income and benefits for demobilized troops.

Firms seeking to make the transition to civilian production should plan carefully for the changeover. In particular, defence industry managers, engineers and production workers needed retraining if they were to adapt to the cost and performance requirements of civilian production. The firms themselves must be restructured to enable them to develop the marketing capabilities necessary for success in private markets. In the past, many firms seeking to expand civilian production had failed to take those critical steps, which had led to unsuccessful experiences and disillusionment with conversion.

Conversion had worked in the past. For instance, following the Korean War, several companies had sought to expand their non-military businesses. While the Boeing Company had successfully developed its commercial aerospace business, other firms had fared less well, primarily because they had failed to carry out the advanced planning, retraining and corporate restructuring necessary for success. Washington's failure to maintain consistent procurement policies after the Viet Nam War had also contributed to the demise of Boeing-Vertol's effort to develop subway cars.

Currently, many firms were pursuing conversion successfully. Others were diversifying by acquiring non-military assets while retaining their military capabilities. None of the nation's largest prime contractors were pursuing conversion, although several were implementing various diversification strategies. Without conversion, however, lay-offs and economic decline would be the legacy of the cold war.

E. Session IV

Economies and markets

Warren Phillips indicated that Russian enterprises involved in the production of military equipment and services were facing severe financial difficulties, not only in the continuation of their normal activities but also in the conversion of their production from military to civilian products and the training of their personnel in market-oriented strategies of survival. The situation had led to the development of three major goals in connection with cooperation with the West in conversion activities: (*a*) cash now; (*b*) membership in the international economy; and (*c*) long-term growth.

The core of successful conversion rested in the change from state-owned enterprises to market mechanisms. Such change represented a psychological adjustment rather than a structural one. The move from the Western "cost plus fixed fee" concept (the military industry's way of pricing products and services) to a "firm fixed price" method (the delivery of products and services familiar to the average manufacturer in the West) entailed profit, but more often risk, deferred reward and client support. Another aspect of conversion required replacing the concept of "society protected by the party" with "society protected by the legal system", if Western business partners were to be readily found.

The West was most often interested in buying parts, not whole systems. For instance, the Fairchild Company had announced its interest in buying titanium fasteners for rocket construction; it was not interested in buying the rockets themselves. It would be easier to arrange those types of sales if the parts industry was spun-off and divided into several production companies, each operating independently and in competition with each other.

Intellectual property—the work developed by joint initiatives on a particular problem—was easier to deal with than patent rights. For several legal reasons, patent rights were very difficult to protect, both for the inventor or enterprise as well as the Western partner. Programmes such as NASA's problem-oriented science applications programme could be quite successful in financing the refocusing of the science community on civilian problems. To save scientific capacity was not the same thing as trying to save all the scientific institutions created in the Russian Federation. As in any society, the Russian enterprise system was built with a number of objectives. It was not necessary to save every enterprise or military science institute. Rather, it was essential to nourish and support Russian science in general.

The speaker said that it would be advantageous for the military-industrial complex to spin off small consulting firms whose expertise was focused in such specific areas as information technology, ecology or business management studies. Too frequently the only focus was on production, but the intellectual properties of the military industries could also be harnessed for

profit in consulting firms. In addition, he said there was a real need to address infrastructure needs and not just product sales. Banking, insurance and legal support for conversion must support those efforts if real success was to be achieved.

Alexander Ermishin noted that, in Russia, conversion of military production and privatization of state-owned enterprises were considered an indivisible process. Privatization meant conversion of property, which included more than just conversion from military to civilian production. Therefore, privatization must come first, he said, in order to stimulate the military conversion process. Reforms in the areas of ownership of the means of production and responsibility for work results were taking place all over the world. The Saratov Aviation Plant had been converted into a collective enterprise in October 1991, and by 1992, all the industrial funds of the plant had been redeemed by the joint owners' investments and the plant's profits. In addition, the Conference of Joint Owners—a supreme organ of Russian enterprise management—had decided recently on the transition of collective enterprises to joint-stock companies, in which each joint owner became a shareholder.

In the process of privatization, the Saratov Aviation Plant had been completely converted to a self-financing enterprise, owing to the increase of its export production. As a result, labour discipline had improved, staffing had stabilized, and incidences of law-breaking had decreased. The average wage of middle-level employees had increased 4.6 times, exceeding the wage level of employees in machine-building enterprises in the Zavodskoy region. Special efforts had also been made in pursuing the conversion of military production to civilian use. For example, a Russian-American joint-venture enterprise—"Conavia"—had been organized between the Saratov Plant and the Chilewich International Corporation. Conavia's main activities involved the production, processing, storage and trade of agricultural products. Military production of the Saratov Aviation Plant had been limited to only 40 per cent of the total volume of production, and the employees released from military production lines had been placed in new jobs within the plant.

Lewis Franklin provided a brief summary of a number of ongoing research activities at the Stanford Centre for International Security and Arms Control (CISAC), namely: defence conversion and privatization research and support activities *vis-à-vis* Russian companies; United States defence restructuring research and policy development; and studies on proliferation and related trade and commerce issues.

The United States defence business was a highly regulated activity, and the procurement of defence purchases by the Department of Defense was prescribed by the Defense Acquisition Regulations, a large collection of codified policies and procedures based on Congressional legislation and Executive Branch policies. Overall, the Regulations represented a collective attempt to standardize the procurement process, ensure fairness in competition, and establish accounting standards for "cost-plus" and other forms of contracting. However, over the years, there had been innumerable additions and augmentations to the Regulations, partly in response to past contracting abuses, so that they now had little resemblance to commercial contracting practice, and in fact prescribed business behaviour that was commercially inefficient and non-competitive. As a result of extensive training of the staff and management of United States defence companies in those practices, few in the industry were prepared to compete and operate profitably in the commercial business environment.

The speaker suggested the deregulation of the defence industry through a priority policy change of the next United States Administration. The benefits of deregulation could be dramatic: (*a*) for companies whose leadership initiated such change, resulting in the unshackling of an over-constrained industry; and (*b*) for the nation, in that it could result in a smaller but healthier industrial defence base in which the defence industries were no longer a drag on the economy but a powerful economic thrust in the renewed global competitiveness of United States business.

Victor Glukhikh presented two options for consideration in connection with conversion of the aerospace industry in Russia and its integration into the civilian economy. The first option consisted of the gradual change-over of research and development and industrial capacity to the manufacture of civilian consumer goods. Although specific features of aerospace technology limited the use of that approach to a certain level, it could be applied to military enterprises where accumulated experience, production equipment and research and development expertise might be profitably utilized.

The second option envisaged the direct use of aerospace technology for peaceful applications that would enhance economic efficiency and render foreign partners a service on a commercial basis. There were proposals to use existing military-function aerospace facilities for the development of satellite communications systems, global environmental monitoring equipment and other modern scientific techniques for enhancing socio-economic development in the post-cold-war era.

Hansjürg Kobelt gave his views on conversion based on the experience of the Swiss Federal Aircraft Factory (F+W), a 40-year old government-owned company, which was facing difficulties in converting to civilian market rules. The speaker gave a number of examples to illustrate the company's activities, the problems encountered, and the conclusions reached, including: (*a*) production of a dual-use VTOL transport aircraft with a 1.5 ton payload; the lesson learned from that experience was that technology, innovation and a potential market were not sufficient for the success of conversion; (*b*) that it was necessary to provide decision makers with the right information at the right time in order to create long-lasting cooperation; no specific funds were required for that process, but mutual long-term confidence, the willingness to cooperate, and political and market influence were equally important factors; (*c*) that the licensing of technologies resulted in mutual respect for management and technical levels; and (*d*) that the company had cooperated with three other Swiss firms in the development and production of nose fairings for the European space launcher ARIANE.

Margaret Gilleo and *Mary Ann McGivern* presented a case-study of St. Louis, Missouri, United States of America, a city that depended on military aerospace industry and where the McDonnell Douglas Company, 1,500 smaller prime contractors and subcontractors and the Defence Mapping Agency and other military aerospace installations employed a total of 85,000 workers. The authors presented the issues those firms and installations faced in the process of conversion, and described the political strategies, including financial opportunities, developed by members of the Regional Economic Adjustment and Diversification Committee, a working group comprised of specialists in various areas of public policy. The paper placed particular emphasis on management retraining, flexible manufacturing, worker participation in decision-making, marketing assistance, business incubators, financial incentives, and a regional industrial coordinating policy. It was pointed out that the search for manufacturing that met human needs involved finding a specialty niche, facing technology transfer issues, and building a common vision of society.

Lester L. Wolff said that we were now in a time for peace, a time when the forces, energies and resources that had been dedicated to destruction could now be marshalled towards solving the multitude of problems that faced the peoples of the world–such would be our future market-place. The market already existed, it did not have to be artificially created, but it would require a talented international cadre to accomplish the adaptation of military technologies. There were many obstacles to conversion, some of them in the minds of men, and though there would always be a need and a market for military equipment, that market was now smaller and exhibited a diminishing potential.

The speaker recommended that an efficient marketing infrastructure in the form of a Resource Centre for Trade and Privatization be established through a major coordinated effort. Such a centre would be managed by an experienced marketing group together with scientists, engineers and technicians who would engage in strategic planning to develop a comprehensive programme that would exploit existing technology through joint ventures, manufacturing and licensing; managers would be empowered to engage in face-to-face negotiations with their counterparts. The centre would also organize and facilitate trade missions and trade fairs in such areas as agribusiness, biotechnology, electronics, manufacturing, communications, machine tools, and medical, environmental and transportation equipment.

F. Closing session

1. Closing speech by Oleg Lobov

The most important conclusion reached by the participants in the Conference is that the conversion of the aerospace industry has begun. In fact, it has become irreversible. And the participants in this work are not only scientists and those engaged in production, but also a country's politicians.

To the extent possible, in the little time that could be spared from the Conference, visits were arranged to enterprises in two branches of the industry in Russia. However, this was only a fraction of the number of industries that should have been visited and discussed. It was not possible for you to visit Krasnoyarsk, Omsk, Sverdlovsk or St. Petersburg, where the heaviest concentrations of aerospace enterprises are to be found and where intensive work is being carried out. It is where government orders for military technology have been reduced several times. In addition, government orders have been reduced for a whole series of products intended for purely civilian purposes, such as aircraft, satellites and rocket launchers.

For that reason, the aerospace industry is unquestionably experiencing a certain crisis. But at the same time I think that the heads of the enterprises, the scientists and the engineers have not lost interest in their work. Consequently, the enterprises in many regions already have definite plans for overcoming this crisis. In fact, they have begun to overcome the crisis

and we already have excellent examples of conversion in enterprises where the proportion of civilian production amounts to 80 per cent or more.

A few final words. I think one of the important results of our work was the recommendation on expansion of cooperation in the field of aerospace technology. There will be many proposals in the future regarding joint flights to the moon and to Mars, and a global system of communications and information technology, which will have a deep influence on the development of humanity. At the same time, solutions must be found to the current problems facing many countries in their transition to market economies, especially in the Commonwealth of Independent States and in Eastern Europe.

It is important that people have understood that conversion cannot be undertaken halfway. Conversion must be complete. It must be carried out so as to be irreversible. Consequently, the process of disarmament must also be complete. No one should think that the ideology based on limited information exchange will win, where one side has something or controls something and is able to prevent other countries from acquiring some obscure process. That may be possible for a limited time, but only up to the critical point when information becomes uncontrollable. This is particularly the case when trying to control military technology and the creation of deadly weapons. In order to prevent a global catastrophe, scientists, engineers and the public must speak out in favour of a complete ban on military technology. We are not Utopians believing that conversion can be achieved within a year or even within a decade, nor that we will enter the twenty-first century without shells and bombs. Nevertheless, we must work jointly towards this goal, reasonably and carefully, elaborating international instruments and creating the necessary environment for the peaceful development of humanity. The broader the international programmes relate to technology for peaceful purposes, the greater will be our success.

I should like to thank the United Nations and organizations such as the United Nations Development Programme (UNDP), the United Nations Educational, Scientific and Cultural Organization (UNESCO), the United Nations Industrial Development Organization (UNIDO) and the other international organizations that have made this Conference possible. I should like to thank the Russian Academy of Administration, who provided us with conference facilities, housing, meals and a forum for social contacts. I should like to thank all the speakers who shared their thoughts with us and did so with great enthusiasm. It was evident that this was a theme close to their hearts and that they understood the needs of the aerospace industry. I should like to say that Russia has opened its doors wide to international cooperation. Russia is ready to participate in international programmes directed towards peaceful development. We invite you to come back to Russia again and again and to work on these problems that confront humanity.

2. Closing speech by Joseph Ben-Dak

It is with great pleasure that I now speak at the closing ceremony of the Conference. Conversion is an activity which concerns not only the economy of Russia but also people's minds. Some say that conversion in people's minds involves even more complex processes than conversion of equipment and machinery. In this regard, I would like to emphasize the difficulty of the conversion already accomplished. However, looking into the future, we need to achieve more complete and better conversion. Consequently, this is what we have tried to do at this Conference, because half-hearted conversion is a very dangerous process.

We have accomplished a great deal at this Conference. We are grateful to you for this achievement. I shall take with me the recommendations made by the Conference, convinced that conversion is both a measure and an undertaking which we must support in every way. For that reason, together with the United Nations Secretariat, UNESCO and UNIDO, we in UNDP will make the greatest efforts to continue the work on conversion.

Some of the ideas expressed at the Conference were not discussed in detail. For example, the excellent programme for the mobilization of public opinion in Saint Lucia which definitely should be replicated to some extent in Russia. Another very useful idea concerned incubators, which was referred to when the possibility arose of creating new products, new goods and opportunities.

The scale on which conversion is now being carried out is unprecedented. There are still many failures in the process of conversion. Perhaps there are even more failures than successes. However, considerable work on conversion has been done in Russia and the work is evidently proceeding more satisfactorily than in other countries of the world. Russia has an enormous potential for conversion and the more convertible factories and plants we see, the more apparent will be the success of this conversion.

The future of all nations lies in ensuring that cooperation results in the conversion of new factories producing new and valuable goods and services which will be used to finance the current process of conversion. Consequently, regional centres for conversion

and cooperation, international centres for cooperation, mutual links, and interdependence, will be of benefit to the entire world community. Each State should participate in the production of, and benefit from, goods and services which the convertible aerospace industry makes it possible for them to produce.

The aerospace industry is very competent and highly technological in many countries of the world, particularly in Russia. Placing our hopes in a better future for mankind, we will all benefit from civilian production and we must hope that more such products will emerge from this industry for the benefit of all.

In conclusion, I should like to say that we are entering a new era. This has been an historic Conference.

3. Closing speech by Herbert Levin

I think that it will be useful to glance into the past and to take a look at the present and the future. As far as the past is concerned, the United Nations was pleased to provide the external assistance needed for the preparation and holding of the Conference. In various working groups it has been said that the United Nations is working towards a solution of problems, and that enormous amounts of money and financing are required to give effect to those solutions. As regards financing for this Conference: $50,000 was provided by the United Nations Development Programme, and a further $50,000 by the United Nations Department of Economic and Social Development. In addition to the $50,000, the Department provided 1.4 million roubles that remained from the former Soviet Union contribution to the regular programme budget of technical cooperation of the United Nations. These sums turned out to be insufficient, and a member of the Rockefeller family, who wishes to remain anonymous, provided a further $10,000.

Another important area of United Nations responsibilities—apart from financing an area in which two specialized agencies of the United Nations participated—was the drawing up of a list of the principal speakers on the fundamental issues of the Conference. We were unable to secure speakers from all concerned countries, but even so we provided an opportunity for many outstanding specialists to speak.

On behalf of the United Nations, I should like to say that we did not try to reach agreements. We were trying to ensure that principles and approaches were worked out. As Mr. Yashin said, we were pleased that different approaches and methods were being put forward for the solution of the same problems. That was a source of satisfaction to us.

You are aware that the report of the Conference will be issued. If this serves to assist your work in a positive way, that will mean that the Conference has been useful.

VI. Working group reports

A. Working Group A: Spacecraft, missiles and launchers

Report of Donald A. Lewis, Rapporteur

Introduction

During the past three decades, the design of products produced by military-industrial complexes was driven by requirements that have few, if any, parallels in today's typical civilian markets. Minimization of cost, for example, was generally not a first order requirement. Rather, high performance and application of sophisticated technology and engineering were more important for many military goods, the best examples being ballistic missiles and aircraft. Pricing, a related but different factor, was rarely tied to cost and certainly was not moderated by true market forces.

A different emphasis was placed on the criteria for product lifetime, serviceability, safety and efficient use of labour and materials, for example, than for civilian goods. Unlike military product lines which typically catered to a limited customer base with limited competition, civilian products must address the demands of a broad base of consumers and must constantly compete for their attention. As a consequence, the success of conversion activities will be directly tied to the scope and effectiveness of marketing activities. For example, comprehensive market research is required to assess consumer demand for specific goods in specific market sectors and to determine designs that will sell.

The technology and manufacturing prowess in the East and West is probably adequate to supply basic consumer goods to the civilian economies of the world. There may be some outdated facilities and processes that limit the production of some high-tech goods, but low-tech products represent the bulk of the market demand. Thus, technology is not necessarily a product-limiting factor; failing to produce and sell the right product may very well be.

Presentations

The topic addressed by Working Group A was the conversion of industrial facilities, previously used for manufacturing military rockets and missiles, into facilities for the manufacture of civilian goods. The expressed purpose of this Working Group was to address the many issues associated with conversion of those facilities and develop recommendations for policy makers and others intimately involved in the conversion process. However, owing to the rather ambitious agenda of presentations, the opportunities for discussion were limited. This report summarizes the presentations and recommendations.

The Working Group was given an excellent tour of the Khrunitchev Machinery Plant. Highlights of the tour were the opportunity to walk through a true scale mock-up of the Mir space station with several of the modules attached and a close-up examination of the Proton launch vehicle. The tour also included an opportunity to examine several examples of the civilian products now manufactured by converted industrial capacity. These products included medical technology output, consumer goods, food processing equipment and industrial components.

The papers presented to the Working Group addressed a broad range of aerospace technologies and manufacturing facilities that are either undergoing conversion to civilian purposes or are available for future conversion. In keeping with the area of interest assigned to the Working Group, the papers addressed technologies for conversion based on space-launch systems (rockets and missiles) and satellites. Only one non-Russian paper was presented. The general organization of all of the Russian papers was essentially the same. They provided exhaustive enumerations of the various technologies that were suitable for conversion and the expected civilian sector product lines that would result. There was little mention of the socio-economic, financial or industrial barriers to conversion.

The following papers were presented:

Conversion strategy in the aerospace industry in Russia and development perspectives

Aerospace conversion activities at the V.P. Makeyev Research Bureau

Alternative considerations associated with industrial conversion in the space industry

Conversion activities at the General Machinery Research Bureau

The launcher Rus project: development of space complexes for the needs of civilian industries

National programme for transport system development as the basis of a new means of transport

Civil projects and technologies for using and utilizing liquid-fuel ballistic missiles: the Proton launcher improvement

Aerospace technologies and materials in commercial use

Using the Almaz station for the needs of agriculture, ecology, geology and science

Experience in aerospace technology conversion

Recommendations

1. The Russian Space Agency should establish an international system of ecological monitoring and ecological control, based on wide-scale conversion of military complexes.

2. Russian and international private companies, in cooperation with the Russian Space Agency, should finance an all-weather remote-sensing programme for environmental monitoring and resource management; existing Russian satellites could be used.

3. New products for space should be developed by using traditional avenues of financial cooperation, such as bilateral contracts; joint ventures should be set up with stockholding corporations and companies.

4. Products resulting from conversion and their concomitant costs and pricing should be consistent with domestic and international market demands.

5. The financing of military-industrial complexes undergoing conversion should be consistent with domestic and international financial systems to ensure efficient capitalization of successful enterprises and an appropriate return on investments for investors and domestic economies.

6. Institutional barriers to conversion, both domestic and international, should be minimized in order to ensure efficient market development; however, the maintenance of national industrial bases necessary for ensuring national security should not be put in jeopardy as a result.

7. The conversion community should become familiar with international marketing strategies to ensure success for its "conversion-derived" products.

Report of Valentin Stepanov, Co-Chairman

Topics for discussion

Conversion of the Russian rocket and space industry

State assistance

Reorientation of the Russian rocket and space industry to meet national economic, scientific and commercial needs

Proposed projects

Ensuring non-proliferation of missile technology

Facilitating and inhibiting factors

In Russia and in other countries of the CIS, active use is being made of the enormous accumulated scientific and technological capabilities in rocket and space technology; a state-of-the-art rocket and space industry has been created, as well as a strong experimental base and test sites. For example:

A state system for the training of large numbers of highly qualified specialists for the rocket and space industry has been organized and is functioning;

Scientific research institutes and design bureaux are carrying out research and development programmes in all areas in which the Russian rocket and space industry is active;

A policy of bringing enterprises and organizations of the rocket and space sector into a market economy is being actively pursued;

A variety of new organizational forms is being developed for joint ventures with foreign firms;

One factor inhibiting the development of the Russian rocket and space industry is the significant reduction in state financing for programmes in that area and the absence of private investment, in addition to the crisis facing the Russian economy.

Recommendations to policy makers

1. Firms, organizations and private individuals willing to invest capital in joint ventures with organizations and enterprises in the Russian rocket and space sector should be encouraged to do so.

2. State policies and the laws of the Russian Federation should guarantee a favourable climate for the development of mutually advantageous international cooperation in this sector.

3. Organizations and enterprises in the Russian rocket and space industry should be prepared to work

jointly with foreign private and state organizations and enterprises and private individuals on a mutually advantageous commercial basis.

Recommendations to the international community

The Russian rocket and space industry is prepared to provide for the joint development of, or to fill orders in Russia for the development and production of, launch vehicles and entire space systems (including launch equipment and other technical systems), the value of such projects being in the range of at least $7 billion to $20 billion a year. In connection with those activities, the Working Group believes that the following actions should be taken as soon as possible:

1. The lifting of restrictions on the use of Russian ballistic missiles for the launching of spacecraft for the benefit of other countries.

2. The implementation of programmes in basic scientific research of the planets of the solar system, the development of international systems for environmental monitoring, the rational exploitation of natural resources, the elimination of radioactive waste in industrial production, and the development of information, telecommunications and navigation systems.

3. Support for the proposal put forward by Russia and other countries regarding the creation of collective security systems, under United Nations auspices, to provide early warning of missile attacks and verification of international treaties and agreements.

4. The production, under United Nations auspices, of high-purity medicines and materials in outer space.

5. Russia could propose and organize training courses in rocket and space technology, to be held in Russia, particularly for personnel from developing countries.

Recommendations to researchers and commercial enterprises

1. Propose the implementation of scientific and commercial projects and programmes by organizations and enterprises affiliated with the Russian rocket and space industry.

2. Undertake joint ventures in programmes relating to:

(*a*) The use of ballistic missiles as launch vehicles for commercial space projects and other tasks;

(*b*) The modernization of the Russian "Vostok" and "Proton" launch vehicles for commercial use, and the design of new launch vehicles;

(*c*) The use of the "Energia-Buran" heavy-lift transport system and its modified versions;

(*d*) Further work in the area of civilian applications for dual-use space technologies;

(*e*) The production of high-technology equipment for civilian sectors such as medicine, pharmaceuticals and biotechnology.

B. Working Group B: Communication and navigation

Report of Vladimir Shimko, Co-Chairman

Main aims of conversion

The Working Group formulated three main aims of conversion:

The preservation of the intellectual potential of enterprises under conversion;

The use of technical/scientific bases and industrial capacities for design and production for peaceful purposes;

The use of military navigation and communication facilities for the sake of national economy.

Recommendations

1. Conversion should be carried out on a global scale or among countries with developed military industries.

2. Programme direction and conversion coordination should be carried out on a global scale, with the main centre at the United Nations; a network of regional centres should also be established in order to confirm and coordinate conversion activities.

3. Those centres, in cooperation with national organizations and linked by a common database, should establish a mechanism to consolidate the resources necessary for the creation of a global information network for aerospace complex conversion, and create the conditions for specialist training.

4. National Governments should undertake the major coordination and financing aspects of conversion programmes, especially in the area of advanced technology.

Proposal by Lloyd S. Etheredge

This proposal concerned a project for establishing an international scientific network. It was pointed out that within the next few years, significant technological developments (for example, new generations of fibre-optic cable, digital encoding (ISDN) and video compression techniques, direct-broadcast satellites and global cellular networks) would create unique opportunities for new forms of routine scientific communication. As

a first step, it would be timely to design and put into operation a United Nations scientific satellite channel that would support scientific innovation in areas of high priority, conduct experiments, and accumulate experience on behalf of the international scientific community. The objectives of the proposal would be to:

Design and evaluate options for the use of new telecommunications technology that would stimulate the process of scientific, medical and industrial innovation by:

Allowing scientists to communicate at a much earlier stage of the creative process;

Creating open-architecture systems and organizing financial support to ensure participation by scientists in all countries and in all scientific specialities;

Providing support for solving common problems and policy questions with scientific and international components (including those addressed by United Nations programmes);

Allowing research and development-oriented corporations to identify and establish contacts with research developments and researchers worldwide;

To take prompt advantage of the end of the cold war by building new foundations for global security and cooperation. Specifically, to use emerging communications technology to create new global networks for routine and mutually-beneficial working relationships between academic institutions, research institutes, and research and development-oriented corporations.

C. Working Group C: Remote sensing and environmental monitoring; the social aspects of conversion

Report of E. David Hinkley, Rapporteur

Overview

Aerospace conversion in support of global, regional and local programmes of resource monitoring and environmental control and protection has resulted in a unique opportunity to simultaneously address two pressing global problems involving mankind's survival: minimizing the danger of war, and improving the state of our habitat under ever-increasing population pressures. A number of measures could be employed to solve these problems, including:

The use of military technologies for tackling environmental problems;

The increased manufacture of satellites for specific civilian objectives;

The application of materials, equipment and technologies of the aerospace industry to sectors that deal with natural resources and the environment;

The assessment and reduction, if needed, of the adverse environmental effects of both military and civil aerospace activities.

The use of space satellites capable of high-resolution photography and multi-spectral remote sensing for monitoring and control of the environment, mineral resources prospecting, monitoring farmland and forest areas, and measuring atmospheric and hydrologic phenomena is technically and institutionally achievable. The physical principles and information technologies applied in the case of military and civilian use of such space vehicles are similar, and the conversion process will, in a number of instances, involve minimal technological modification.

The transfer of the unique materials and technologies of the aerospace industry to civilian sectors—for example, in the manufacture of sewage and solid waste treatment facilities, or to make conventional processes and products less energy and materials-intensive—is not a simple task. Such a transfer calls for a considerable initial investment, elimination of inter-agency barriers and red-tape inertia, and an effort to create and finance the demand for nature conservation equipment by Governments and private entrepreneurs.

In order to address the problems of military aerospace technology conversion, the Working Group suggests the following activities:

Identify the end user for all resource and environmental remote sensing so as to develop the market and obtain financing; employ advanced technology and conversion to reduce the cost of spaceborne and airborne remote sensing in order to help make such projects financially feasible; apply business "due-diligence" analyses to identify the opportunities that have the greatest potential for commercial success;

Enhance international cooperation by:

Sharing equipment installed on satellites and aircraft;

Improve land-based infrastructure and technologies for processing and timely analyses of data for the purpose of identifying and evaluating anthropogenic effects on the environment;

Review remote sensing capabilities being used for treaty verification in terms of their applicability for environmental monitoring, including the detection of space debris.

Discussions on the social problems of conversion revealed a consensus by the participants that in the

aerospace industry, the threat of unemployment, the loss of social status and income, and the apparent lack of adequate advance notice of job change and retraining options, constitute real and very pressing problems for technically competent people. The solution to such problems challenges the compassion and competence of national Governments, and provides both an area for wider international cooperation in research and technology and a compelling basis for implementing the process of conversion.

Opportunities and constraints

The opportunities for spaceborne and airborne remote sensing and conversion in support of ecological, resource and environmental monitoring and control are local, regional and global in scope. Local issues include land-use planning, air and water pollution, and natural disaster prediction. Regional issues include natural resource analysis, forest ecology and fires, ocean ecology and productivity, agricultural productivity and pest assessment, weather and severe storms, and acid rain. Global issues include global warming, ozone layer depletion and climate change. Each of these issues demands a particular type of remote-sensing instrument, and necessitates conversion of aerospace technology.

The constraints are primarily related to the funding of spaceborne and airborne missions, and to marketing of the data. Historically, government organizations have been the primary users of environmental, resource and ecological data, and they have paid for it. Although information derived from such data have important human and ecological implications, government funding is not available for some of these data sets. Accordingly, the market potential for commercialization of such information should be thoroughly researched to develop a user base and establish the framework for comprehensive business assessments that would lead to financially practicable private company initiatives.

Recommendations to policy makers

Financing issues

1. As the costs of spaceborne and airborne remote sensing are reduced, commercial applications will become more practicable. The use of advanced aerospace materials and subsystems in space instruments will reduce weight, size and power requirements, and allow the use of smaller, less expensive launch vehicles. Assessments should be made of the savings that would be realized through the conversion of existing military launchers. Such assessments should be made from a total systems standpoint.

2. Based on recent assessments of existing space data from commercial organizations and from initiatives based on higher-level information, commercial initiatives in remotely-sensed environmental data should concentrate on higher-level products with greater added value. Moreover, there is greater potential for successful commercialization of data from natural resources remote sensing (oil and mineral deposits, forestry, for example) than from atmospheric remote sensing.

Institutional/organizational issues

1. Within a single country there should be collaboration between various organizations in order to obtain the maximum use of available resources. The organizations should jointly identify the users of the data obtained from remote sensing, the opportunities for conversion and the potential for commercialization.

2. International cooperation should first focus on the sharing of existing remotely-sensed environmental data and on participation in the conversion programmes and their development. Use should be made of special instrumentation or of launch vehicle or data-processing expertise that is available from various countries, in order to maximize the overall efficiency and cost-control of the programmes and to obtain timely results.

Training

To establish an efficient and continuing procedure for cooperative remote sensing and conversion, appropriate government and private sector managers must be trained so that they can adapt to new processes and provide effective leadership. Aerospace companies and newly developing smaller companies should provide in-house training on the overall aspects of remote sensing commercialization (technological appropriateness and readiness, economics, marketing and financing, for example) in order to be in a position to develop self-sustaining organizations.

Research and development

The use of advanced materials and micro-electronics in spacecraft and instrument structures will reduce their mass and size, permitting smaller, less costly launch vehicles to be used. Launch vehicle costs could be further reduced by converting available military boosters to civilian use; however, the appropriateness of research and development on such conversion should be considered in the overall analysis.

Markets

The ultimate users of spaceborne and airborne remote sensing data should be established for each of the local, regional and global categories. The financial and commercial potential should then be evaluated by a thorough analysis that involves a "due-diligence" procedure. By implementing these procedures, the market for remote sensing information and its commercial potential can be established.

Forms of cooperation

1. Within a single country, three primary forms of cooperation should be developed: the first would involve military aerospace, civilian aerospace and "user" organizations as the process of conversion is implemented; the second would involve educators working with the aerospace organizations in order to develop skilled managers, engineers and technicians for the conversion process; the third would involve business-development assistance in areas of technology assessment, economics, marketing and finance in order to develop financially practicable enterprises.

2. International cooperation would consist of workshops relating to existing and planned remote-sensing programmes, and exchange visits to determine instrument, launch vehicle and data-sharing requirements in support of those programmes. International collaboration would also be necessary to assess the appropriateness of treaty-verification data for environmental purposes.

Recommendations to the international community

The international community, including Governments, should assist in the conversion process and in the development of remote-sensing capabilities for government and commercial purposes through the following measures:

(*a*) Provide tax breaks and/or direct support for relevant work (subsidies could be removed after a specified period);

(*b*) Facilitate international collaboration;

(*c*) Establish training programmes for conversion;

(*d*) Identify and support related research and development;

(*e*) Encourage commercialization;

(*f*) Hold collaborative workshops.

Recommendations to the research community

Researchers should expand their activities in order to support effectively the conversion and commercialization processes as follows:

(*a*) Assist in the development of low-cost remote-sensing alternatives;

(*b*) Share data and programmatic information with other colleagues and institutions;

(*c*) Enhance education in advanced technology, conversion processes and their applications;

(*d*) Undertake research and development in booster and military aerospace technology conversion;

(*e*) Expand interaction with commercial firms;

(*f*) Cooperate with colleagues in the sharing of data, technologies and programme ideas.

Recommendations to the commercial sector

The world community will benefit from remote environmental and resource monitoring if commercial firms are successful in demonstrating that the entire process is financially feasible for certain applications. In order to accomplish this, entrepreneurial firms should:

(*a*) Perform business "due diligence" procedures of the entire process including technology assessment, economics analysis, marketing and financing options;

(*b*) Evaluate strategic alliances;

(*c*) Support appropriate training for aerospace managers;

(*d*) Identify the maturity of the technology being considered for conversion and its possible commercialization;

(*e*) Perform complete market analyses;

(*f*) Develop economically feasible forms of collaboration.

D. Working Group D: Aviation

Report of Jürgen Brauer, Rapporteur

Owing to the large number of prepared statements, the Working Group was unable to discuss the merits of the individual suggestions and proposals included in those statements, and therefore cannot present a jointly agreed-upon set of recommendations. Nevertheless, a number of individual proposals are listed below:

Individual proposals

1. Organize a commission to monitor the channelling of loans to the Russian Federation.

2. Create an international centre for conversion technologies, perhaps using the existing Moscow centre as a model and local affiliate. (Similar proposals: (*a*) create an international conversion consulting structure; (*b*) establish a technology centre through the

United Nations to help sustain the technological capabilities of the Russian Federation.)

3. Create a working group on information flows relevant to conversion; create an information data bank, especially on pertinent conversion laws in the Russian Federation.

4. In response to Russian appeals for better access to Western markets, an appeal was made to Russian and non-Russian companies to labour jointly on products for sale in Russia and to make joint use of Russian technology for non-aerospace markets in Russia.

5. It was suggested that development alliances between Russian and non-Russian firms be formed where Russia supplies its technology and non-Russian firms supply marketing and financing skills.

6. It was suggested that Russia might wish to examine the existing and potential markets of developing nations.

7. Russia could legislate alternative energy use in order to create a new market to be supplied with products based on Russian aviation technology.

8. Russia might wish to engage more forcefully in converting its aerospace technology to applications in agricultural machinery.

9. The United Nations could buy Russian aircraft for use in search and rescue and emergency missions.

10. An international consortium could be set up whose task would be to sell Russian aircraft to international markets.

11. Non-Russians could buy non-majority shares in the Russian aviation industry.

12. A non-Russian expert in aviation engines suggested that Russia promptly begin negotiations on bilateral agreements for Russian engine certification in non-Russian markets, such as the United States Federal Aviation Administration and the Joint European Airworthiness Authority.

International

1. Initiate bilateral negotiations that would lead to the adoption of universal standards between civilian aircraft agencies such as the Russian Register, the United States Federal Aviation Administration and the Joint European Airworthiness Authority.

2. Join ongoing international programmes for ageing aircraft rejuvenation. Provide and exchange knowledge base and test stands, for example.

Russian

1. Prepare a register of technologies, materials, systems and expertise available in Russia.

2. Approach international banks or funding organizations for support in the provision of loans for specific programmes leading to the integration of proven, reliable and available Western systems with Russian aircraft and systems. The loans would be repaid after commercialization. The funding bodies should also be requested to provide the necessary expertise for marketing and financing.

Research and development

1. Research and development on technologies related to wind tunnels, high-speed trains and simulations should be carried out at Russian laboratories and facilities wherever possible.

2. Russian laboratories should be encouraged to provide such services on a commercial basis and with sufficient transparency. A handbook on the facilities available is to be provided. Exchange of information, visits to Russian laboratories by outside scientists, and the support of Russian scientists in laboratories outside of Russia should be encouraged. A clearly defined exchange programme with adequate finances should be set up.

3. Long-term projects of international interest, such as the development of unducted fan engines which have the potential to reduce fuel consumption by about 40 per cent, should be realized with a large initial Russian participation, thereby exploiting the spare capacity available in research and development in Russia as a result of conversion. Funds for such programmes should be found among participating nations.

In the statements and discussions, no one had disputed the claim that the Russian aviation industry was fully capable of technical feats of the highest order. Nevertheless, a number of Russian participants expressed fears that "the West" was simply interested in weakening the Russian aerospace industry and converting Russia into yet another third-world supplier of raw materials, and was not willing to heed the many pleas for transfer of financing and marketing skills to Russia. There were repeated calls for preserving the Russian aviation industry, including its military capabilities.

In contrast, most non-Russian participants suggested that Western aviation markets might already be crowded, that financing from international organizations such as the United Nations would not be forthcoming, and that Russia would be better advised to concentrate not only on conversion from military to civilian aviation but also on conversion of its aviation technology to non-aviation markets, especially for the potentially large Russian civilian market.

In addition, it was emphasized that if Russia intended to compete with non-Russian firms in interna-

tional markets in the aviation arena, it would have to pay close attention to such matters as the reliability of aircraft and aviation systems and their proper certification, ease of operation and maintenance, and especially to a steady, easily accessible supply of aviation spare parts.

Report of Evgeny Fedosov, Co-Chairman

The aerospace industry of developed countries plays a unique role both in the structure of defence potential and in the creation of national technological culture; it also affects research and development priorities as well as a State's structural and industrial policy. It is evident that conversion of this branch of industry must be most closely related to the needs of the civil market, that it can and must play a significant part in the social, economic and cultural development of the world community, and that it must yield positive results relatively quickly. These results could become the guarantee of a more stable peace, the stimulus for the development of mutually beneficial international cooperation, and provide the evidence that delivery from the burden of military rivalry is of great benefit to mankind.

Russia has a poor transportation network in the northern and eastern parts of the country. Air transport plays a vital role in these regions. Therefore, civil aviation is the main priority of aviation industry conversion. Having considered the prospects of such conversion, the following is suggested:

Establish mechanisms for cooperation

Mechanisms should be established for large-scale cooperation between Russia and foreign States that would integrate governmental and non-governmental efforts in aviation industry conversion. These mechanisms should provide the background for conversion of military industries in relation to carrying out major joint programmes in civilian production, strengthening economic infrastructure, modernizing technology and equipment and integrating advanced civilian production into the world economy. In this connection it would be expedient to set up an organizational structure (possibly in the form of a special international foundation or centre) to:

Define the common interests of defence enterprises and possible areas of international cooperation in the area of conversion, initially in the form of large-scale international projects;

Supply consultative, informational and other services in connection with the development and implementation of international conversion projects;

Carry out research and development and supply information services for conversion and defence enterprises commercialization;

Organize independent studies of projects, concepts and decisions in respect of defence industry conversion, with possible participation of international experts;

Maintain data banks on defence enterprises conversion potential;

Develop and implement training and retraining projects and programmes for managers of enterprises subject to conversion;

Organize conferences and seminars on defence industry conversion and develop personal contacts for the purpose of information and experience exchange;

Develop recommendations for Governments on the main trends for assigning priorities with respect to joint conversion projects, with provisions for the development of product certification criteria for joint efforts on the basis of international quality standards.

Learning from other projects

Air transport and new-generation high-speed railways will benefit from large-scale joint projects on conversion of the aerospace complex. The most interesting projects are:

The current generation of Russian trunk-route aircraft (the Il-86, Il-96 and Tu-114 from the Ilyushin and Tupolev plants) is being developed and configured with engines supplied by Rolls-Royce (United Kingdom), General Electric, Pratt & Whitney (United States) and SNECMA (France), and instrumentation from Rockwell-Collins, and Honeywell (United States);

The joint trainer project—the Mikoyan plant (Russia), General Dynamics (United States) and Dassault (France);

The joint aerospace complex project—MAKS aerospace system and An-225/Horol—to develop space vehicle air launch from An-225 "Mria" aircraft, carried out by Russia, Ukraine and the United Kingdom;

The "Burlak" joint project—air start of a commercial satellite launcher;

The joint project of ecologically pure twenty-first century aircraft using hydrogen fuel (the Tupolev design bureau);

The air traffic control system modernization projects for CIS airspace, carried out by the GATSS consortium (Westinghouse, Hughes, IBM, AT&T (United States), DSA (Germany), C-Ito (Japan) and Thomson-CSF (France);

The development of an airfields network in Russia that would include former Soviet Union Air Force airfields under conversion;

The high-speed St. Petersburg-Moscow railway project, developed by a joint-stock company called "High-speed Railways", allows a wide involvement of French and German companies who possess the necessary technologies and experience of the creation of similar transport systems in Europe.

Such joint projects could provide the basis for further cooperation between Russian enterprises under conversion and Western companies, and assist in integrating Russia into the world economy.

A difficult problem to which the Governments of our countries must pay attention is the lack of initial funding for project implementation. The potential profitability of conversion projects will ensure the availability of bank credit. However, the Russian Government has not yet defined mortgage commitments and a number of organizational issues must be solved. Credits given to Russia under intergovernmental agreements by the European Community and in the form of humane assistance must be used to fund projects to a certain extent. Russia must become a party to international standards and agreements in the area of transportation systems and seek membership in all relevant international organizations. The participation of Governments in partial investments in projects and in the creation of favourable conditions for their implementation is essential.

Statement by Hansjürg Kobelt, Co-Chairman

The Co-Chairman of the Working Group said that he admired the state of the art of Russian aerospace technology and took note of the projects suggested for Western cooperation and financing. He also noted that the Russian participants and those from Western industrialized countries had approached the subject of conversion from different perspectives, and was of the opinion that the speakers from the West had tended to impose their approach on that of the East. However, even if a technological adaptation worked well in the West, it must be adjusted to Eastern society. The Co-Chairman also stated that cultural differences must be understood and accepted if strong and durable ties were to be established between nations, and that cooperation and assistance required the recognition of each other's weaknesses.

Annex I: Agenda

Monday, 12 October

Registration and reception:

10.00-18.00 Registration

10.00-17.00 Local excursions (visit to Space Centre and/or sightseeing)

Tuesday, 13 October

09.00 **Opening ceremony (*Plenary*)**

Opening of the Conference:

Oleg Lobov, Chairman of the Expert Council to the President of the Russian Federation, Chairperson of the Organizing Committee

Opening statements:

1. Georgy S. Chyzha, Deputy Prime Minister of the Russian Federation
2. Herbert Levin, Special Adviser to the Under-Secretary-General, Department of Economic and Social Development, United Nations

Greetings:

Russian cosmonauts from the Mir space station

Keynote addresses:

1. Representative of the United States Government
2. Joseph Ben-Dak, Principal Adviser, Technology Transfer and Adaptation, United Nations Development Programme
3. N. Jasentuliyana, Director, Outer Space Affairs Division, Department of Political and Security Council Affairs, United Nations
4. Valery Alaverdov, Vice General Director, Russian Space Agency

Conference structure and general information:

1. Erazm Omeljanovsky, Secretariat of the United Nations Organizing Committee
2. Sergei Zemljenoy, Secretariat of the Local Organizing Committee

11.00 **Aerospace technologies and conversion: dreams and reality (*Plenary*)**

Chairman: Seymour Melman, Chairman, National Commission on Economic Conversion and Disarmament, United States

1. *Conversion for development*

Joseph Ben-Dak, Principal Adviser, Technology Transfer and Adaptation, United Nations Development Programme

2. *Technology transfer*

John J. Rosati, President and Chief Executive Officer, Bainbridge Technology Group, United States

3. *Economic feasibility*

Ksenia Gonchar, Institute of World Economy and International Relations, Russia

4. *Social aspects*

Gennady Osipov, Russian Academy of Sciences

5. *Cooperation*

V. S. Arunachalam, Former Head of the Defence Research Development Organization, India

6. *Market and trade*

Herbert Wulf, Arms Trade Project Leader, Stockholm Peace Research Institute, Sweden

15.30 **Policy, security and legal issues (*Plenary*)**

Chairmen: Karl-Heinz Böckstiegel, Director, Institute for Space Law, University of Cologne, Germany

Yury Yashin, State Technical Committee, Russia

1. *Trends in the aerospace industry in the post-cold-war era and the potential for, and obstacles to, conversion*

Reiner Rupp, North Atlantic Treaty Organization Headquarters, Belgium

2. *Roles of companies, communities and Governments in assisting aerospace conversion*

John Tepper Marlin, Director, Conversion Information Centre, United States

3. *The potential of environmental applications of aerospace technologies*

Victor Danilov-Daniljan, Ministry of Ecology, Russia

4. *Soaring over the great divide: policies and perspectives for successful aerospace conversion*

Lloyd (Jeff) Dumas, University of Texas (Dallas), United States

15.45

1. *Aerospace technology transfer and the proliferation of sophisticated arms*

Jürgen Scheffran, Institute für Kernphysik, Technische Hochschule, Darmstadt, Germany

2. *Opportunities and problems of West-East and North-South cooperation in conversion of the aerospace industry*

Angelo Airaghi, Senior Vice-President, Finmeccanica, Italy

3. *Conversion of science and technology resources to civilian objectives: exigent needs, political implications and constraints*

Yury Yashin, State Technical Committee, Russia

4. *Training of managers in the conversion process*

Manfred Bethin, University of Dortmund, Germany

Wednesday, 14 October

9.00 **Country case-studies in the conversion of aerospace companies** (*Plenary*)

Chairmen: Andrei Kokoshin, First Deputy Minister, Ministry of Defence, Russia

Lloyd (Jeff) Dumas, University of Texas (Dallas), United States

1. *Lessons from China: the result of the country's large-scale conversion programme*

Shi Chang Jie, Ministry of Aerospace Industry, China

2. *Lessons from Germany: conversion of the aerospace industry: the German experience*

Jürg Huffschmid, University of Bremen, Germany

3. *Lessons from Brazil: coping with scarcer resource alternatives for the Brazilian space programme*

Lauro Fortes, Brazilian National Institute for Space Research

11.00

1. *Lessons from India*

Rakesh Sood, Director, Office for Disarmament, Ministry of Foreign Affairs

2. *Lessons from Russia: the impact on the aerospace industry of transition to a market economy: recent experiments*

Andrei Kokoshin, Deputy Defence Minister, Russia

3. ***Problems of conversion of the aerospace industry under market economic conditions***

Nicolai Petrakov, Russian Academy of Sciences

4. ***Lessons from the United States of America***

Gregory Bischak, National Commission for Economic Conversion and Disarmament

14.00 Parallel working groups

Working Group A

Spacecraft, missiles and launchers

Chairmen: Valentin Stepanov, Ministry of Industry, Russia

Robert H. Schmücker, Space Technology Institute, Germany

Rapporteur: Donald A. Lewis, The Aerospace Corporation, United States

Agenda for discussion:

Selecting new products; redesigning plant facilities; the safe conservation of dangerous military equipment; environmentally sound technologies; the working environment; converting ballistic missiles and launch equipment to civilian needs; the conversion of space weapons systems to civilian research projects in areas such as precision guidance systems, industrial lasers, and astronomical optics; structural reforms of the aerospace complex; the functions of State bodies in governing the conversion process in science and industry; measures of conversion at space enterprises; the formation and role of federal space centres; the use of ground-based space facilities (launch sites and equipment, space objects control, satellite information retrieval); the utilization of military space facilities for civilian purposes; the demonopolization and commercialization of space activities; privatization, small businesses and joint ventures.

Working Group B

Communication and navigation

Chairmen: R. Michael Wright, Manager, Ordnance Survey International, United Kingdom

Vladimir Shimko, President, Radiocomplex Corporation, Russia

Rapporteur: Robert A. Gessert, Programme Director, Logistics Management Institute, United States

Agenda for discussion:

Disaster relief; the development of topographic maps and domestic navigation systems; telecommunication for isolated areas; information networks; property rights; the establishment of a global information network for education; managing international data banks and global satellite networks; access of developing countries; how to reach those not yet reached; informatics.

Working Group C

Remote sensing and environmental monitoring: the social aspects of conversion

Chairpersons: Wang Yu-Sheng, Ministry of Aerospace Industry, China

Victor Kutzenko, Ministry of Ecology, Russia

Rapporteur: E. David Hinkley, University of California, United States

Agenda for discussion:

Pollution control; exploiting and prospecting natural resources; forecasting of earthquakes; ocean environment research; systems for control, planning and monitoring of forestry, agriculture and fisheries; short- and long-term weather forecasting; institutional infrastructure for managing natural disasters; detecting forest fires in remote areas; the control of ozone contamination; astronomy; training for management of satellite ground-stations; the establishment of regional centres for space science and technology in existing national/regional education institutions; global networks for environmental protection.

Working Group D

Aviation

Chairmen: Hansjürg Kobelt, Swiss Federal Aircraft Factory, Switzerland

Evgeny Fedosov, Director, State Research Institute of Aviation Systems, Ministry of Industry, Russia

Rapporteur: Jürgen Brauer, Assistant Professor of Economics, Augusta College, School of Business Administration, United States

Agenda for discussion:

The establishment of regional centres for aviation science and technology in existing national/regional education institutions; high-altitude aircraft for environmental measurements; models for local on-site planning; the consideration of long-term production competence; estimating the market of new products; reorganizing transportation networks; managing public aviation transportation; the conversion of military airports; models of defence enterprises (joint-stock companies, cooperatives, joint ventures); the role of small and medium-sized enterprises; planning for reduced defence contracts; the access of private industry to military aircraft industry research.

Thursday, 15 October

09.00 **Economies and markets (*Plenary*)**

Chairmen: Sergio Barabaschi, Ansaldo Corporation, Italy

Rostislav Tikhonov, Rector, Russian Academy of Management

1. *Cooperation for conversion*

Warren Phillips, Department of Government and Politics, University of Maryland, United States

2. *Basic models for conversion of the aerospace industry and gained experience: market and non-market models*

Alexander Ermishin, Director-General, Saratov Aircraft Plant, Russia

3. *Problems and prospects for conversion*

Lewis Franklin, Stanford Centre for International Security and Arms Control, United States

4. *Conversion of the aerospace complex in Russia*

Victor Glukhikh, First Deputy Minister of Industry, Russia

11.15

1. *The experience with conversion: highlights and obstacles*

Hansjürg Kobelt, Swiss Federal Aircraft Factory, Switzerland

2. *Challenges to the arms industry*

Herbert Wulf, Stockholm International Peace Research Institute, Sweden

3. *Developing conversion policy: financing strategies, labour management and community interaction*

Margaret Gilleo/Mary Ann McGivern, St. Louis Economic Conversion, United States

4. *Marketing and trade in the conversion process*

Lester L. Wolff, Pacific Community Institute, United States

14.00 **Parallel working groups**

Working Group A

Spacecraft, missiles and launchers

Chairmen: Valentin Stepanov, Ministry of Industry, Russia

Robert H. Schmücker, Space Technology Institute, Germany

Rapporteur: Donald A. Lewis, The Aerospace Corporation, United States

Agenda for discussion:

Political and security issues: space technologies suitable for conversion with great potential for spin-offs and dual-use; the localization of industrial development; using intercontinental missiles as launching systems for micro-gravity payloads; mechanisms to ensure the peaceful use of technologies on the recipient side; principles of conversion in the aerospace complex; restrictions on the proliferation missile technologies; State financing of conversion of the aerospace complex; aspects of the State Space Programme of Russia.

Economic feasibility and markets: sustainable economic development; new models for cooperation between policy, science, industry, culture, and research and development; conforming space application programmes with other national development programmes; international trade restrictions; legal obstacles; market assessment; conversion and diversification

in the aerospace complex; regulations for conversion; legal restrictions and constraints; non-budget financial support of conversion and the means for its expansion; attracting investment; the Federal Space Foundation and its role in conversion; international cooperation.

Working Group B:

Communication and navigation

Chairmen: R. Michael Wright, Manager, Ordnance Survey International, United Kingdom

Vladimir Shimko, President, Radiocomplex Corporation, Russia

Rapporteur: Robert A. Gessert, Programme Director, Logistics Management Institute, United States

Agenda for discussion:

Political and security issues: long-, medium- and short-term conversion planning; systems best suited for conversion; the economics of conversion; the role of science and technology assessment in the conversion process; the future defence potential; dependency and Western assistance; South-South and South-North mechanisms; communication and the environment; decentralized decision-making; planning from above and/or allowing initiatives and directions from below; the role of non-governmental organizations.

Economic feasibility and markets: the defence conversion process in a market-driven economy; trade restrictions; the transfer of technologies and know-how; regional/sectoral conversion; the economic importance of the defence industry; the feasibility of self-financed conversion.

Working Group C:

Remote sensing and environmental monitoring

Chairpersons: Wang Yu-Sheng, Ministry of Aerospace Industry, China

Victor Kutzenko, Ministry of Ecology, Russia

Rapporteur: E. David Hinkley, University of California, United States

Agenda for discussion:

Political and security issues: international agreements; government intervention; traditional secrecy regulations; regulations that act as a barrier to information and technology flows to the civilian sector; international trade restrictions; environmental restrictions; education strategies; retraining of defence workers; required infrastructures and institutional support; institutional obstacles; the "brain drain"; labour mobility; the social costs of conversion; technology transfer; endogenous capacity-building; institutional obstacles; new models for education; planning by law; models of participation by developing countries.

Economic feasibility and markets: production and the role of the State; the legal implications of engaging in direct trade; decisions on investment priorities; disposal of earnings by enterprises; enterprises to undertake

conversion by responding directly to the needs and opportunities of the market; reliable guarantees of profit repatriation for foreign investors.

Working Group D:

Aviation

Chairmen: Hansjürg Kobelt, Swiss Federal Aircraft Factory, Switzerland

Evgeny Fedosov, Director, State Research Institute of Aviation Systems, Ministry of Industry, Russia

Rapporteur: Jürgen Brauer, Assistant Professor of Economics, Augusta College, School of Business Administration, United States

Agenda for discussion:

Political and security issues: the peaceful use of converted technologies on the recipient side; management and conversion within companies; self-initiated innovations such as local information exchanges, leasing agreements and joint ventures; legal obstacles; the reorganization/restructuring of companies; production technologies; the technological gap between weapons systems production and consumer goods assembly lines; quality management and the working environment; international quality standards (ISO 9000); consulting/institutional support; automation.

Economic feasibility and markets: decentralized decision-making; the release of a portion of defence enterprises to the private sector; obstacles for market penetration; readiness for adoption; strategies of the defence industry in declining markets; State orders and the legal possibilities of engaging in direct trade; laws that permit enterprises to dispose of a percentage of their earnings and to decide investment priorities.

Friday, 16 October

09.00 **Reporting session** (*Plenary*)

Chairman: John Tepper Marlin, Director, Conversion Information Centre, United States

Chairpersons/ Rapporteurs: Working Groups A, B, C and D

10.00 Discussions on the reports

11.30 **Closing session** (*Plenary*)

Presentation of the Conference Declaration

Yury Yashin, State Technical Committee, Russia, and Chairman of the Conference Commission

Closing remarks and acknowledgements

1. Oleg Lobov, Chairman of the Expert Council to the President of the Russian Federation, Chairman of the Organizing Committee

2. Joseph Ben-Dak, Principal Adviser, Technology Transfer and Adaptation, United Nations Development Programme
3. Herbert Levin, Special Advisor to the Under-Secretary-General, Department of Economic and Social Development, United Nations

12.30 **Press conference**

Saturday, 17 October

Visits to research and development centres and production plants in and around Moscow

Annex II: Greetings from the Russian cosmonauts of the Mir space station

Ladies and Gentlemen, participants in the United Nations Conference on Conversion of the Aerospace Complex,

Greetings from the crew of the Mir space station.

Your Conference is taking place at a very important moment, as 1992 has been declared United Nations International Space Year. It is very gratifying that this forum has been organized in the country which opened the way for the manned exploration of outer space.

The theme of the Conference, the use of aerospace technology in the civilian sector of the economy for long-term economic and social development, is an extremely timely one. We are certain that the recommendations made by the specialists in various scientific and technological fields who have come together in Moscow from all over the world will receive an attentive hearing from the international community. Practical cooperation among Member States of the United Nations in solving global problems in the areas of manned space flight, the environment and telecommunications is particularly important. As such cooperation is pursued, we should not forget the positive experience gained in the course of previous joint space programmes such as "Soyuz-Apollo" and others.

We are glad to welcome among the participants in the Conference the senior officials of the design bureaux and the directors of the scientific research institutes and factories which created this marvellous orbital laboratory. The laboratory makes it possible for us to do unique work, which is essential in the area of environmental monitoring (including observation of the state of forests and waters), the production of crystals for the electronics industry, and experiments in biotechnology. As a result of conversion, new technologies developed in the aerospace and aviation industries are being applied in other sectors of the economy such as agro-industry, machine-building and medicine.

We wish the Conference participants much success in their work.

Goodbye.

Annex III: List of participants

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Aerospace technology conference recommends creation of global network for environmental monitoring, resource management

NEW YORK, 30 October (DESD) – Establishing international centres for the conversion of military aerospace technologies to civilian use, and creating a network for environmental monitoring on the basis of existing aerospace technologies, were among the recommendations made by experts attending a United Nations conference in Moscow earlier this month.

The international conference, entitled "Conversion of the Aerospace Complex: Technology Assessment for Development", was attended by 467 prominent scientific experts, high-ranking decision makers, planners and entrepreneurs from 26 countries and five United Nations bodies, who unanimously adopted a "Moscow Declaration" containing recommendations on converting military aerospace technology to civilian use. The proposed international centres, particularly at the national and regional levels, would serve to coordinate activities by creating linked databases, providing institutional support for Member States, and providing training and internships, among other things.

The Declaration further urges the international community to extend international agreements on limiting weapons proliferation and arms trade through conversion and to organize international programmes to train personnel–particularly managers of military enterprises in the cost and quality controls required for non-military markets. Recommendations aimed at policy makers include asking Governments to provide specific unemployment benefits for the training of laid-off defence workers and to guarantee private investors in conversion projects in transitional economies protection against such political risks as expropriation.

Aerospace enterprises, in turn, are urged by the Declaration to explore innovative forms of business collaboration, including worker and consumer ownership and the industrial "incubators" concept that substantially facilitates the transition to conversion of small and medium-sized enterprises.

According to the Declaration, the challenge is "to establish a comprehensive conversion process which will minimize the economic dislocation stemming from world-wide reductions in military spending, while maximizing the economic, social and environmental potential in civilian fields". One way to meet that challenge, conference participants suggested, was to use current technologies not affordable to individual countries to create global projects of benefit to all, and within a foreseeable future. An example is the proposed global environmental monitoring network, which could turn the remote sensing satellites and launch vehicles once used for military applications to monitor and control the environment and prospect for mineral resources. Participants also discussed the legal, financial and social problems of conversion and possible solutions.

"Without the sort of conversion plan that we recommended", said conference Vice-Chairman John Tepper Marlin, "there would be no disarmament, nor could we get countries to agree to the kinds of disarmament programmes that are needed." Mr. Marlin, who is Chief Economist to the Comptroller of the City of New York, also chairs the Board of Advisers of the Conversion Information Centre of the Council on Economic Priorities, a non-profit research organization based in New York City.

"The conference took a hard look at what the real commercial opportunities were for the military aerospace industry, particularly in monitoring the environmental effects of pollution, using satellites for remote sensing and developing new civilian aircraft to service domestic and international markets", added Gregory Bischak, Executive Director of the United States'

National Commission for Economic Conversion and Disarmament. "It proposed very useful and important means of international cooperation to promote conversion in the developed and developing world. The international community should take a close look at these proposals as the most immediate means to move the world into a peacetime economy."

This was the first United Nations conference to discuss conversion for a specific industry. It will be followed by workshops on specific recommendations and possibly by other conferences on conversion, in such industries as materials technology, nuclear technology, informatics and biotechnology.

The conference, which took place from 12 to 16 October at the Russian Academy of Management, was organized by the Science, Technology, Energy, Environment and Natural Resources Division of the United Nations Department of Economic and Social Development (DESD) and the Government of the Russian Federation, in cooperation with the United Nations Development Programme (UNDP), the Department of Political Affairs, the United Nations Educational, Cultural and Scientific Organization (UNESCO) and the United Nations Industrial Development Organization (UNIDO). Financing was provided by the United Nations, UNDP and the Rockefeller Foundation.

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